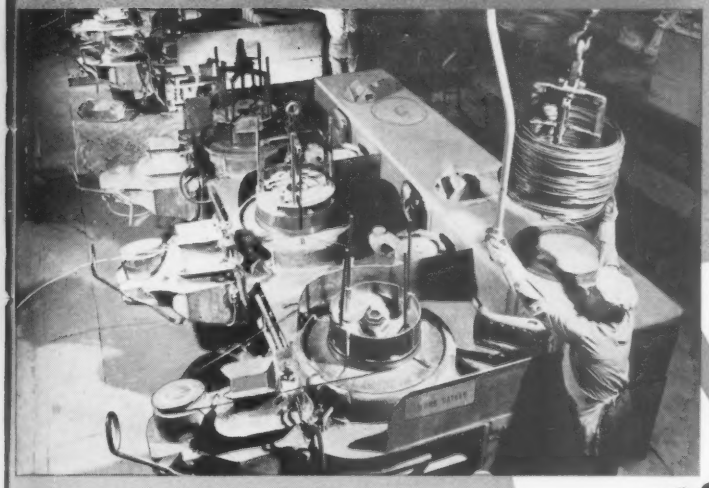
MARCH 1957

WIRE AND WIRE PRODUCTS

HIGH-SPEED COOLING for HIGH CARBON WIRE!



Vaughn®
MOTOBLOC® and MOTOBLOX®
AIR AND WATER COOLED

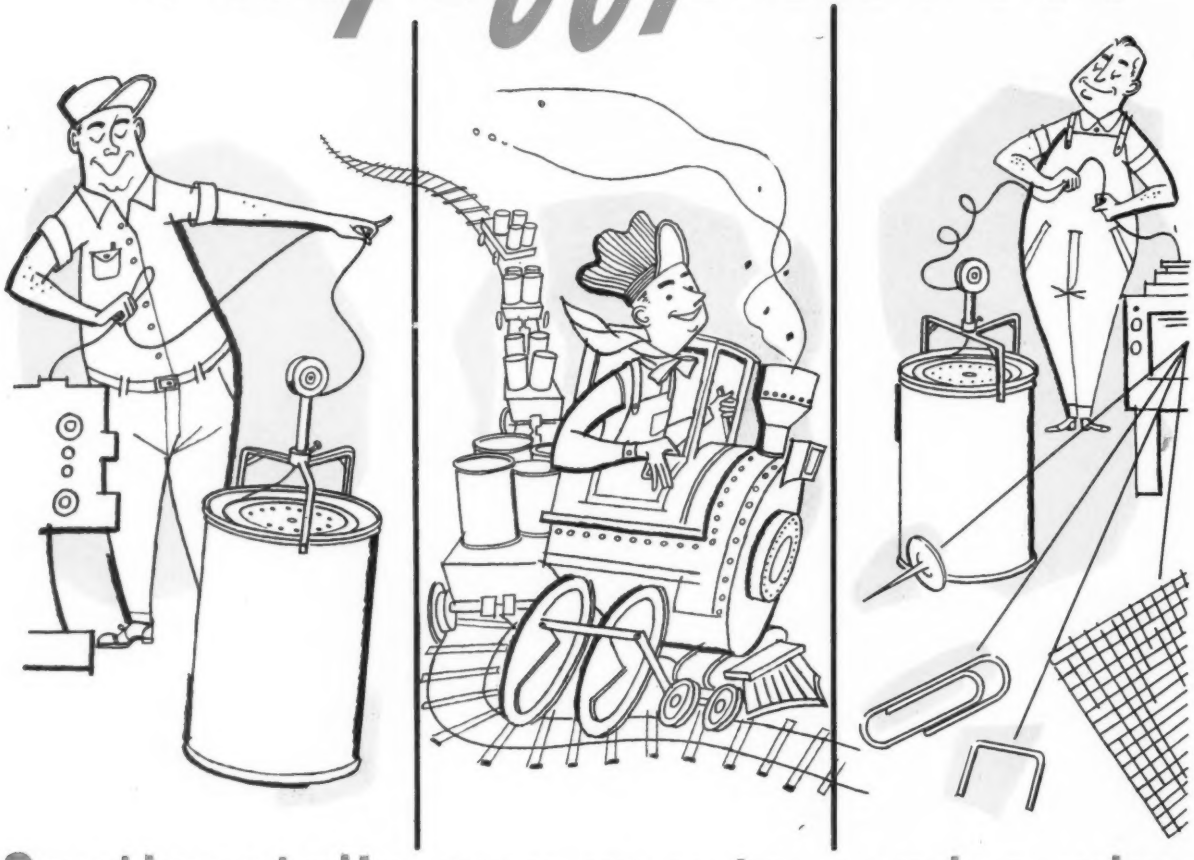
Vaughn says, air *and* water do the job best . . . and proves it in performance! Vaughn *double-cooling* yanks heat out of the wire fast. High sustained speeds are safe and practical with Vaughn high-speed cooling. Let us bring you the facts!

"Quick on the Draw!"

The VAUGHN MACHINERY CO. CUYAHOGA FALLS, OHIO, U.S.A.
COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

Payoffpak®...



Continental's new way to send a wire

By automatically packaging wire as it is drawn, Continental's Payoffpak has revolutionized the handling of wire! These fibre drums put an end to small manually handled coils that are costly to produce and costly to use. What's more, the wire is untouched by dirty or sweaty hands and remains protected in the sturdy drums until ready to use. Lightweight Payoffpaks can hold 600 lbs. of wire each; high stacking strength means you can save on storage space too.

So check into Payoffpak—it will mean bigger profits for you. Call Continental soon for the interesting facts.

CONTINENTAL CAN COMPANY

FIBRE DRUM DIVISION • VAN WERT, OHIO

New York • Philadelphia • Pittsburgh • Tonawanda • Cleveland • Chicago
Atlanta • St. Louis • San Francisco • Los Angeles • Eau Claire • Boston

Quality

is what YOU make it

Top Quality

makes CUSTOMERS

Customers

make JOBS

We of STANDARD believe the use of "America's Finest Wire Draw" will assist in this fulfillment.

MAY WE SHOW YOU HOW?

Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

Standard Industrial
COMPOUNDS CO., INC.

FRANKFORT, ILLINOIS

(A suburban Chicago area city)

Telephones: 2131-2141

LUNDY STEEL PRODUCTS CHOSE

for their new plant at Dunnville, Ontario

E.V.G.

Maschinen & Stahl A.G. of Switzerland/Austria, offer these **four** specialized welding plants, covering the whole field of welded wire fabric—

The HEAVYDUTY (Type G6)—Designed to produce the heaviest meshes (pipe fabric, etc.) wire sizes up to 7/0.

The UNIVERSAL (Type G5) As shown above—For all standard constructions of road slab reinforcing, building mesh, etc.—wire sizes from 3/0 to 11 gauge.

The PRECISION—For fencing and all types of visual mesh. Accurate welding in the lightwire range (gauges 11-15).

The Hi-SPEED—Operating in the fine wire range (gauges 16-22). Mesh spacings as small as ½" x ½".

Specifications and performance data upon request.

Engineered and Built by

ENTWICKLUNGS VERWERTUNGS GESELLSCHAFT

Please direct inquiries to

RICHARD E. KLEINHANS

Authorized Representative in the United States

122 East 42nd Street, New York 17, N. Y. • OXford 7-0770 – 7-0771

Springboard to better wrapping with "Arksafe" Spiral Wrap

For coils, bars, rods and tubings, colorfully printed "Arksafe" spiral wrap offers all the advantages associated with quality packaging... constructed to insure product protection... printed to attract attention and "be remembered"... priced to make its use practical, your operations profitable.

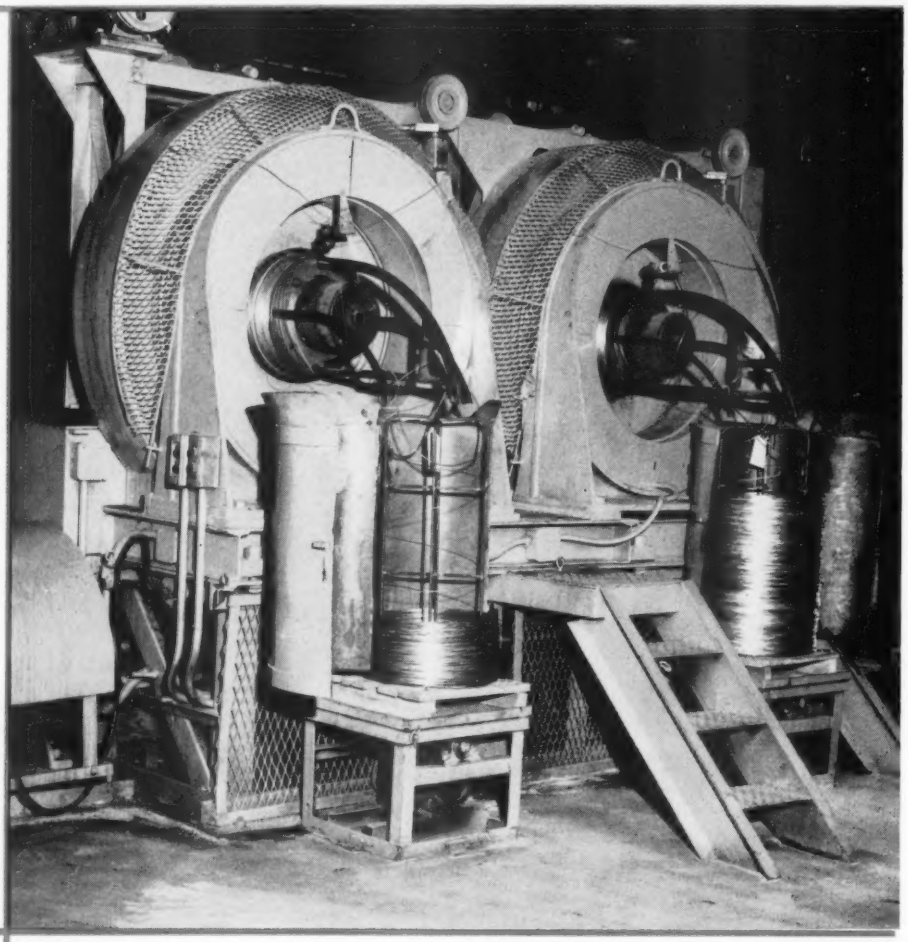
Why accept less?

EST. 1896

ARKELL SAFETY
BAG COMPANY

10 EAST 40th STREET, NEW YORK 16, N. Y. · 6345 WEST 65th STREET, CHICAGO 38, ILL.
PLANTS: CHICAGO, ILL. · NEWPORT NEWS, VA.

MORGAN DEAD BLOCKS



MORGAN
DEAD BLOCK
GALVANIZING
TAKE-UP FRAME

. . . used as Galvanizing Take-Up Frame

SAFE — Blocks are nonrotating.

AUTOMATIC — Wire automatically delivered to stems.

INCREASED PRODUCTION — 100% increase in speeds where pans permit.

LARGE BUNDLES — Will deliver to stationary stems.

WIDE RANGE — Built for wide range of wire sizes.

MORGAN Dead Blocks are available for wire drawing at wire drawing speeds.

MORGAN CONSTRUCTION CO.

WORCESTER, MASSACHUSETTS, U. S. A.

WM98

ROLLING MILLS | MORGOIL BEARINGS • WIRE DRAWING MACHINERY • COMBUSTION CONTROLS

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 32 March, 1957 No. 3

Designated as Official Publication By The Wire Association

Contents

Canadian Regional Meeting of The Wire Association 272

The Wire Outlook 285

Electropolishing Stainless Steels—
A Useful Finishing Process
by William E. McFee 287

Automatic Control of Furnaces Used in Wire Processing
by Leo Walter 290

Effects of Cold Work and Annealing Temperatures on the Grain Size and Hardness of Various Types of Copper Wire
by C. H. Hannon 293

A New Design of Wire Tester For Measuring the Torsional Yield Point of Spring Wires
by W. R. Johnson 298

Chronology of Cobalt
by Dr. F. R. Morral 300

The Geometry of Isodiametric Multicolored Cable
by Sam Kalifon 305

Outstanding Personalities of the Wire Industry 318

Steel Statistics 326

A Review of Recent Wire Patents 327

Copper Statistics 330

Index to Advertisers 347

Where-to-Buy 348-352

WIRE and WIRE PRODUCTS is indexed regularly by Engineering Index, Inc., New York, N. Y.

RICHARD E. BROWN, President and Publisher

R. S. Spengel, Secy.-Treas. & Gen'l. Manager
J. Edward Donnellan, Vice-President

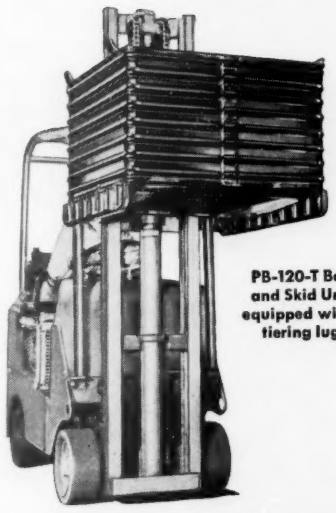
Edmund D. Sickels, Editor

— ASSOCIATE EDITORS —
Lancaster, Allwine & Rommel, Consultants on Patent Information

Publication Office: Jersey City, N. J.
Executive Office: 453 Main St., Stamford, Conn.
* Reg. U. S. Pat. Off.

WIRE & WIRE PRODUCTS, Vol. 32, No. 3, March, 1957. Publication Office at One Sherman Avenue, Jersey City, N. J. Executive Office 453 Main Street, Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Sec'y and Treas. Subscription Price: U. S. $8.00; Canada, $8.00 per year; Domestic 75 cents per copy; Foreign 90 cents per copy, except October Convention Issue and January Proceedings Issue, $1.25 per copy; Foreign $10.50 per year. Entered as second class matter at the Post Office, Jersey City, N. J. under the act of March 3, 1879. Copyright, 1957 Quinn-Brown Publishing Corp.

Scott Printing Company, Jersey City 7, New Jersey



PB-120-T Box and Skid Unit equipped with tiering lugs.

REPUBLIC STEEL

Boxes and Skids

For Handling Wire and Wire Products

Design and construction features of Republic Boxes and Skids help speed movement of materials, conserve storage space, produce savings in all phases of materials handling. Fabricated from heavy-gage steel sheets, they feature deep reinforcing ribs for maximum strength and rigidity.

Units like the PB-120-T, shown above, are manufactured in a wide range of sizes. Republic Materials Handling Engineers will be happy to work with you in designing boxes and skids to meet your specific requirements. There is no cost or obligation for their service.

Write for Catalog 620 on the complete line of Republic Materials Handling Equipment.

REPUBLIC STEEL CORPORATION
Pressed Steel Division
6102 Truscon Avenue, Cleveland 27, Ohio

( ) Please send Catalog 620.
( ) Have an Engineer call.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

Improved

SHAFTLESS TAKE-UP

General Specifications

Both side frames move in or out simultaneously, keeping center of reel traverse always in line with delivery point of cable, thus equalizing and minimizing cable deflection.

Reel gear and drive pinion remain in engagement at all times.

Quick traverse reversing by air valve.

Motor driven screw width adjustment.

Motor driven screw reel lift.

Traverse adjustable for reel width and cable diameter, while machine is running.

Traverse speed adjustable over range of cable diameters in increments of 1/20.

Drive can be supplied to suit customer's requirements.

Mechanical slip clutch friction drive for the capstan.

Variable speed motor drive with manual control.

Variable speed motor drive with automatic electrical control.

Available in the following sizes:

36" dia. reel to 52" dia. max.
36" dia. reel to 72" dia. max.
36" dia. reel to 84" dia. max.
42" dia. reel to 96" dia. max.

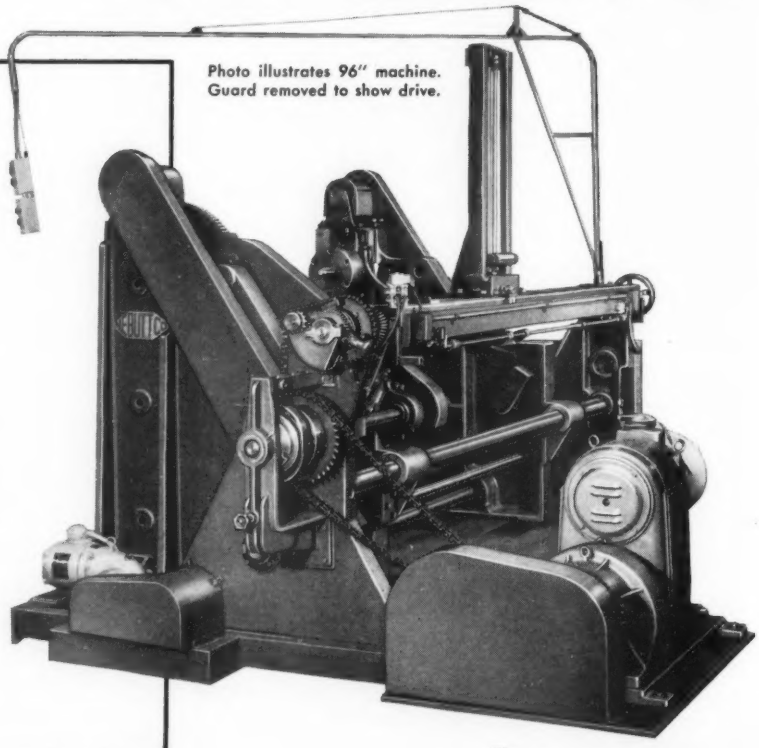
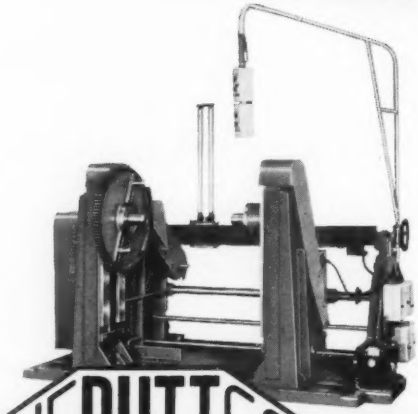


Photo illustrates 96" machine. Guard removed to show drive.

This heavy duty Take-Up includes latest developments which further increase ability to produce high quality cables. Many of these machines, in the previous model, are in continuous, trouble-free operation in plants throughout the country. It handles bare or insulated cables of all weights and sizes at a wide range of speeds . . . is readily controlled by the operator by means of the convenient swinging pendant push button station. Various drives can be provided and the machine readily adapted by our engineers to meet your special requirements. Write us for further information and details.



NEBUTTCO

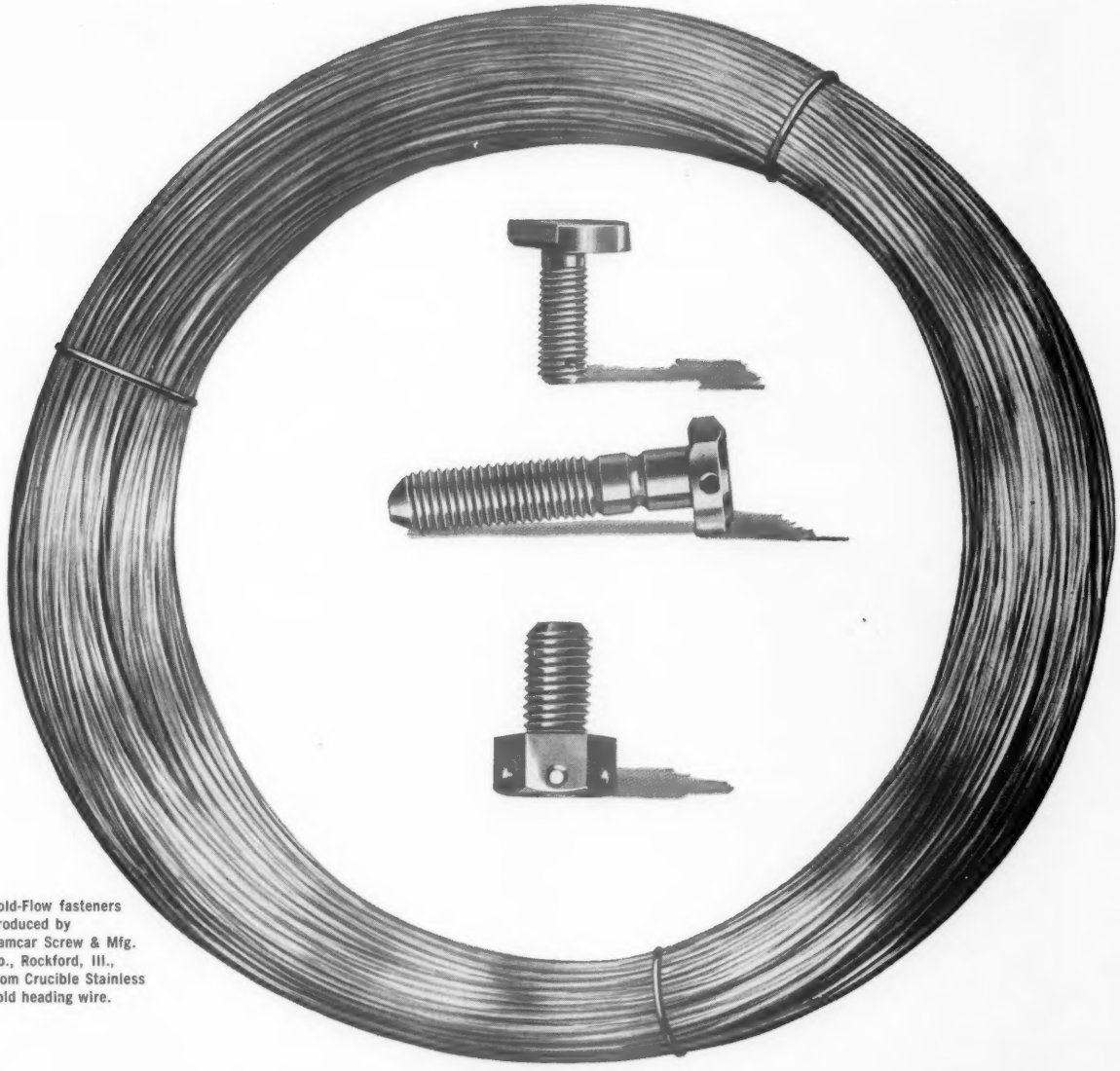
Braiders **Bunchers**
Cablers **Stranders**
Take-ups **Taping Machines**

NEW ENGLAND BUTT CO.

DIVISION WANSKUCK COMPANY

304 Pearl Street · Providence 7, R. I.

In England — James Day (Machinery) Ltd., 28 Maddox Street, London, W-1.



Cold-Flow fasteners produced by Camcar Screw & Mfg. Co., Rockford, Ill., from Crucible Stainless cold heading wire.

fast delivery–wide selection on CRUCIBLE STAINLESS STEEL WIRE

Shipments are prompt on all standard types of Crucible stainless wire—including cold heading, spring, welding, and fine wires. And you have your choice of the widest assortment of grades, sizes and finishes.

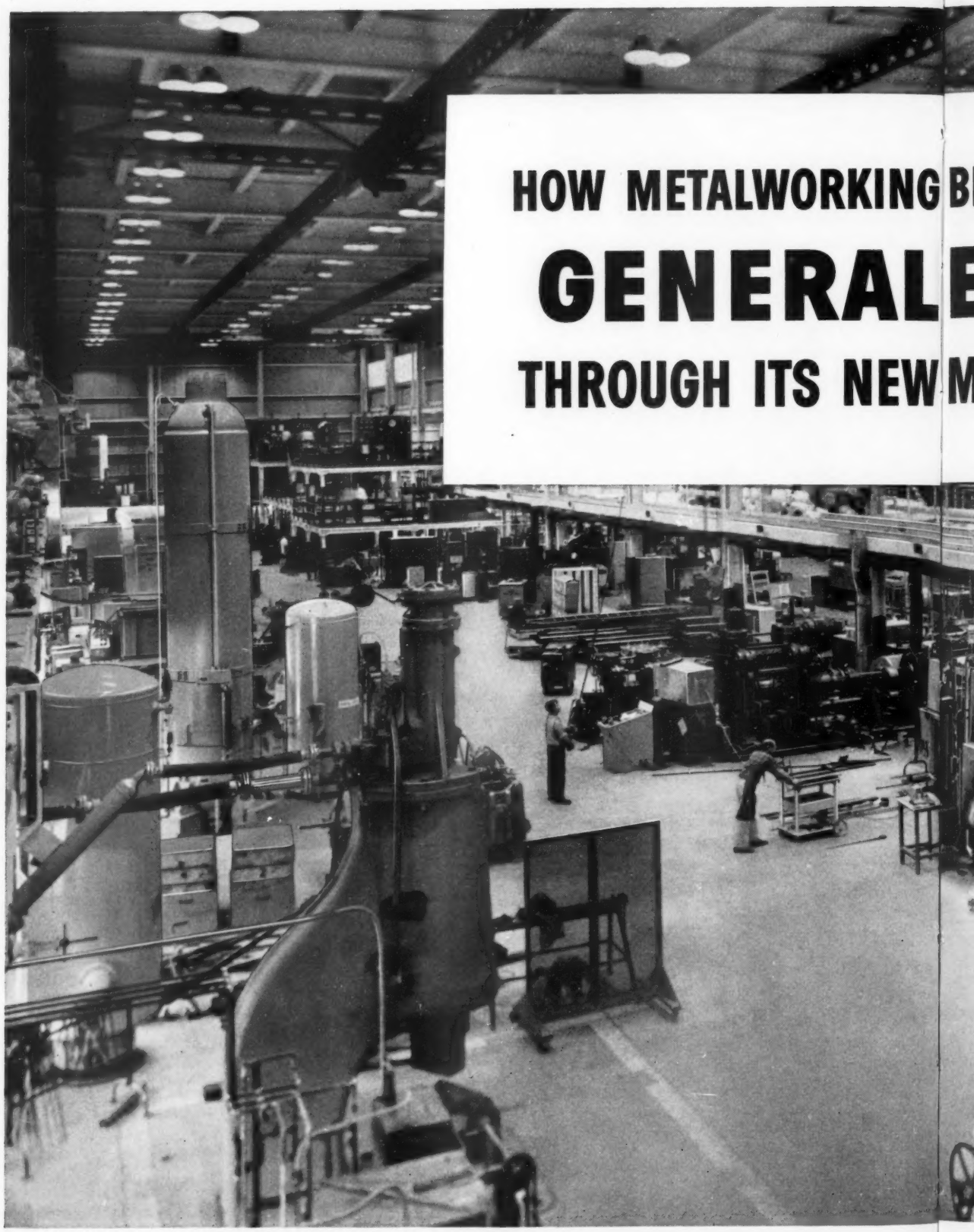
You're sure, too, of stainless wire that is structurally sound and uniform in hardness, sufficiently ductile to make forming easy, and with proper physicals to meet your specifications.

Crucible has the right wire for your job. Your nearby Crucible representative will be glad to arrange for fast deliveries. Tell him your needs. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

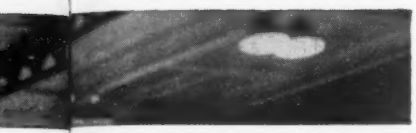
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

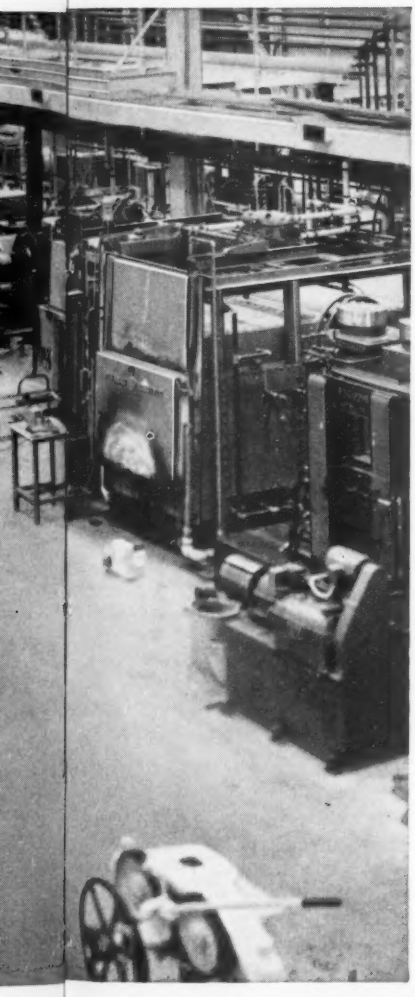
Canadian Distributor—Railway & Power Engineering Corp., Ltd.



Laboratory with factory-size equipment—that's the new $5,000,000 G-E metals and ceramics laboratory in Schenectady. From here will come many of the products manufactured by the Metallurgical Products Department of General Electric Company, 11171 E. 8 Mile Road, Detroit 32, Michigan.



BENEFITS FROM THE RESOURCES OF
ELECTRIC
METALLURGICAL PRODUCTS DEPARTMENT



Solutions to your most pressing problems, plus developments ahead of industry trends, are now being worked out in our laboratories

It doesn't take a crystal ball to know what role cutting tools will play in the Metalworking Industry in the future. The signs are unmistakable.

More accurate casting, extruding, and forging techniques will mean that less metal must be removed by machining. And this will mean that cutting tools must take thinner cuts, and hold closer tolerances.

New and more automatic machine tools will mean that cutting tools must operate at higher speeds – yet provide the longer tool life necessary to give you maximum benefits from automation.

General Electric, through its new Metallurgical Products Department (successor to the Carboloy Department), has already developed several cutting tool materials that are ahead of these trends.

Three years ago, the first of the three Carboloy® Series 300 carbides was announced. Today, these grades permit you to cut harder steels, at higher speeds . . . at lower machining cost per part.

Two years ago, General Electric researchers introduced Cemented Oxide. This material puts mirror finishes on metal, while operating at speeds up to 3000 fpm – far beyond the range of carbides and ceramics.

And last year, G-E Engineers in the Carboloy Machinability Laboratory developed several new machining techniques to help you make better use of these improved materials. One of these techniques lead to a way to utilize carbides at low speeds – starting from 0 fpm – an almost impossible task until now.

All these developments resulted from the vast technological resources which General Electric has brought to bear on metalworking problems – plus the fund of machining knowledge accumulated since G-E first introduced carbides to American industry in 1928.

These resources and this knowledge mean that General Electric–through its Metallurgical Products Department–will be able to recognize and solve new problems of the Metalworking Industry as they arise.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Announcing . . .

A NEW **PLASTIC SPOOL**
and CUSTOM INJECTION MOLDING SERVICE

Hubbard has established a new division for the manufacture of precision made, strong, light weight spools for shipping fine wire. Low in first cost!

The new injection and compression molding facilities enable us to offer a Custom Molding Service for the forming of special plastic objects to customers' specifications.

We shall be pleased to consult with you on your requirements.

SPOOLS MADE BY HUBBARD'S COMPRESSION AND INJECTION MOLDING PROCESS ARE GIVING EXCELLENT SERVICE IN THE WIRE INDUSTRY.

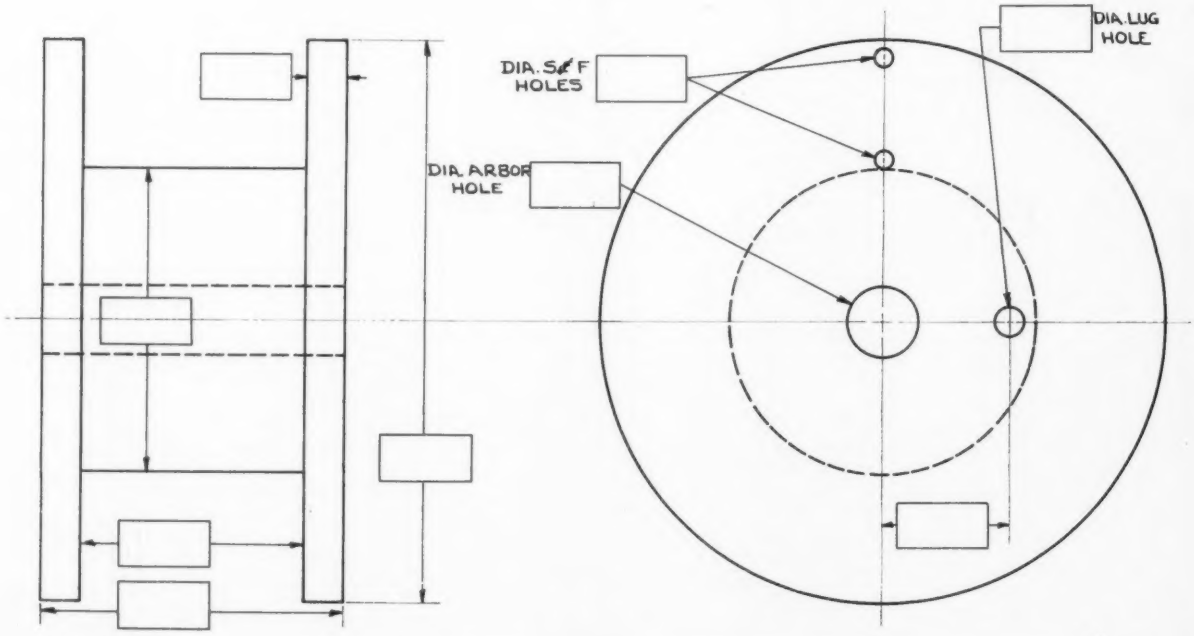
Fill out the form below.

HUBBARD SPOOL COMPANY

GARRETT, INDIANA
Tel.: Garret 840

HUBBARD MAKES A COMPLETE LINE OF SPOOLS AND REELS—ALL CONSTRUCTIONS

TEAR HERE



ADDITIONAL REMARKS (TYPE OF MATERIAL, ETC.)

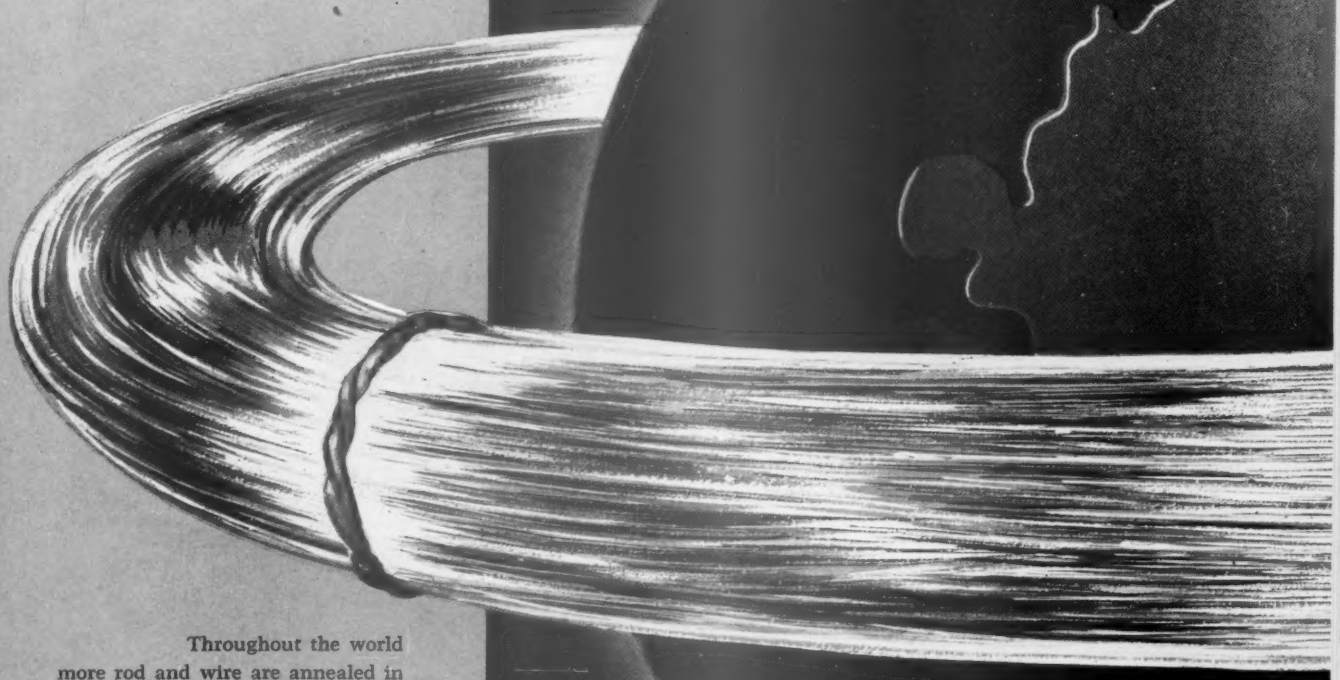
COMPANY NAME

REQUESTED BY

ADDRESS

All around the World..

Wire and rod producers prefer Lee Wilson High Convection Annealing Furnaces



Throughout the world more rod and wire are annealed in Lee Wilson Furnaces than in all other makes combined.

Only Lee Wilson has the quick-heating "O" tube that brings the charge to temperature faster, more uniformly. The Lee Wilson design permits greater concentration of heat around the entire charge and tremendous velocities of hot gas movement within the furnace. And a specially designed diffuser assembly assures circulation down through the spiders to heat the coils from inside as well as outside.

If wire or rod processing is part of your business, be sure you have the finest annealing equipment. Join the leaders the world over and use Lee Wilson Furnaces.

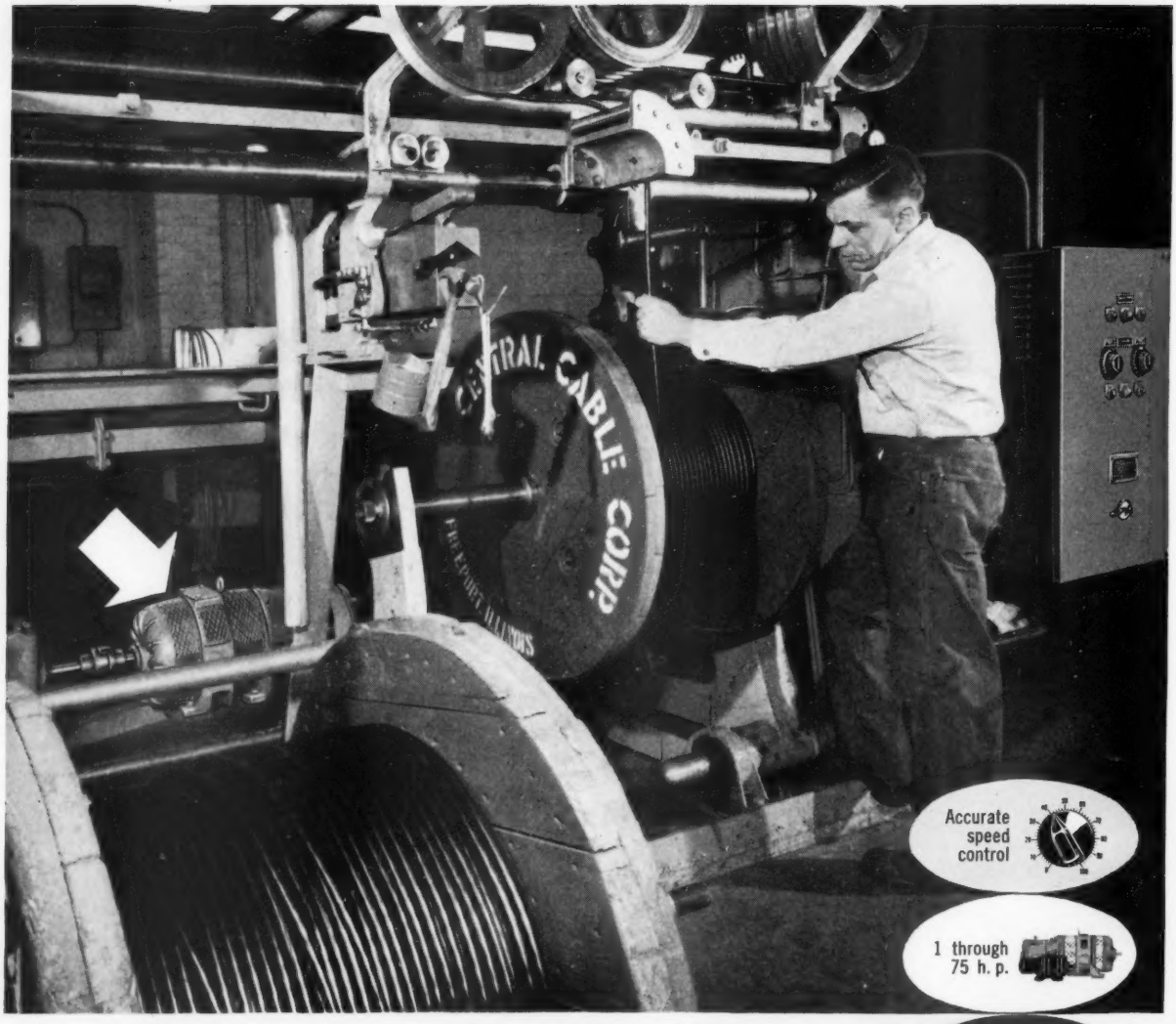
Lee Wilson* ENGINEERING COMPANY, INC.

20005 WEST LAKE ROAD • CLEVELAND 16, OHIO

HIGH CONVECTION ANNEALING FURNACES

MAKE THE BEST METALS BETTER

*ORIGINATORS AND LEADING PRODUCERS OF HIGH CONVECTION ANNEALING FURNACES



How to get higher wire production at lower cost:

Louis Allis provides dependable A. C. adjustable speed drives for wire lines

Here's a dependable tip for boosting production on any continuous extrusion line producing rubber or plastic insulated wire: Louis Allis Ajusto-Spede® can give you simple control of your wire-line process that will assure proper tension on the wire, plus correct relative speed of wire and plastic flow into the die at all times.

The result? Wire coated to a dimensional accuracy that will meet the most rigid specifications . . . produced with excellent uniformity at a high output rate, and with the minimum of scrap.

Louis Allis controls give you "one-dial" master speed control to assure proper synchronization between extruder, capstan, and take-up.

The proof lies in the many successful Louis Allis wire-processing installations. There's a Louis Allis sales engineer in your area who'll gladly give you their names, and who can give you expert advice on the correct drives for powering *your* wire line.

Contact your nearby Louis Allis District Office or write The Louis Allis Co., 451 East Stewart Street, Milwaukee 1, Wisconsin.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

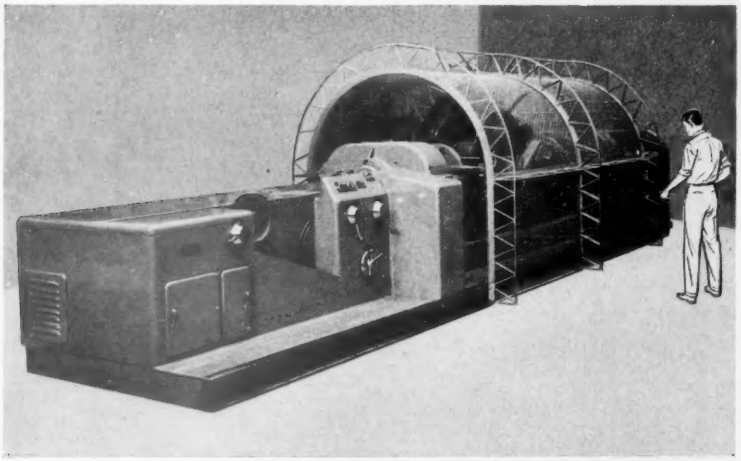
JEAN MAROQUÈNE

PAY LESS

for stranding insulated wires !

Godderidge offers you a new

FLYER-STRANDER which makes it possible



OUTSTANDING FEATURES :

OUTPUT SPEED : 300 ft/min. for all lays.

GREATER LENGTHS : due to 40 inch/take-up reel.

SYMMETRY STRANDING guaranteed by a spécial device.

Number of conductors up to 4; max. cablediameter: 0,8 inch

For further details write to :

Godderidge

11, avenue HENRI-BARBUSSE
HOUILLES (Seine-et-Oise)
F R A N C E

With

NOPCO® KLY

a liquid fine wire drawing lubricant

Be sure to try Nopco KLY next time you're drawing fine size steel or fine and intermediate size copper wire. It's *different*—and everything different about it you'll find is a big advantage.

First, this emulsifiable oil mixes quickly and completely with water—hot or cold. This feature alone is enough to make it ace-high with you. But it has other advantages equally important.

Your bath lasts longer. Nopco KLY has a built-in affinity for water. Its lubricants stay *uniformly active* much longer, since the "drag out" of the lubricants from the solution is reduced beyond anything you've ever seen.

Prevents Formation of Insoluble Copper and Lime Soaps—both the copper soaps, which score dies, clog feed lines and screens; and the lime soaps you've been bothered with when drawing lime coated steel wire.

KLY may be used for high carbon, low carbon, limed, galvanized, and liquor finished fine steel wire—also for fine and intermediate copper, bronze, and brass wire. You'll surely want to try this die-saving, cost-saving lubricant soon. Write today for free booklet "Nopco KLY", which gives full instructions, lists percentages of fat in all emulsions.
Nopco Chemical Company,
Harrison, N. J.

YOU MIX IT FASTER, EASIER

YOUR BATH LASTS LONGER

YOU GET UNIFORMLY ACTIVE LUBRICATION

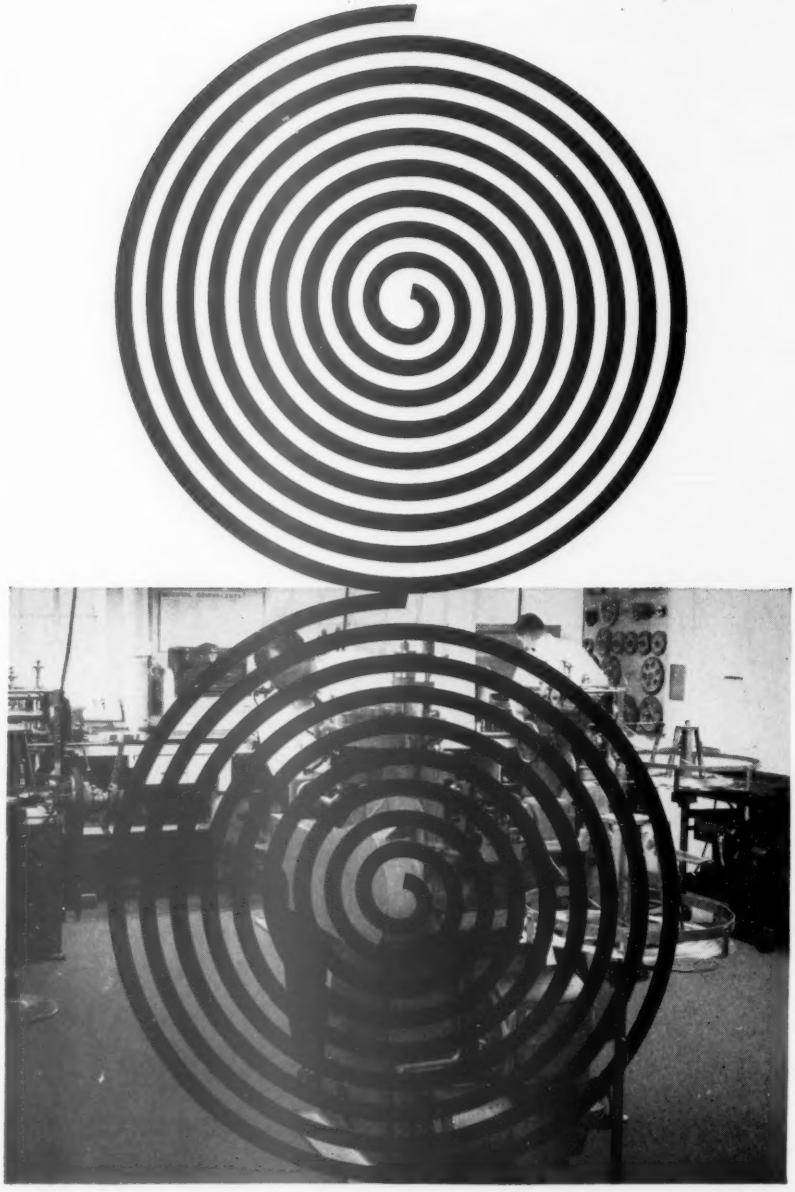
1907–1957 50 Years OF PROGRESS IN CHEMISTRY

NOPCO

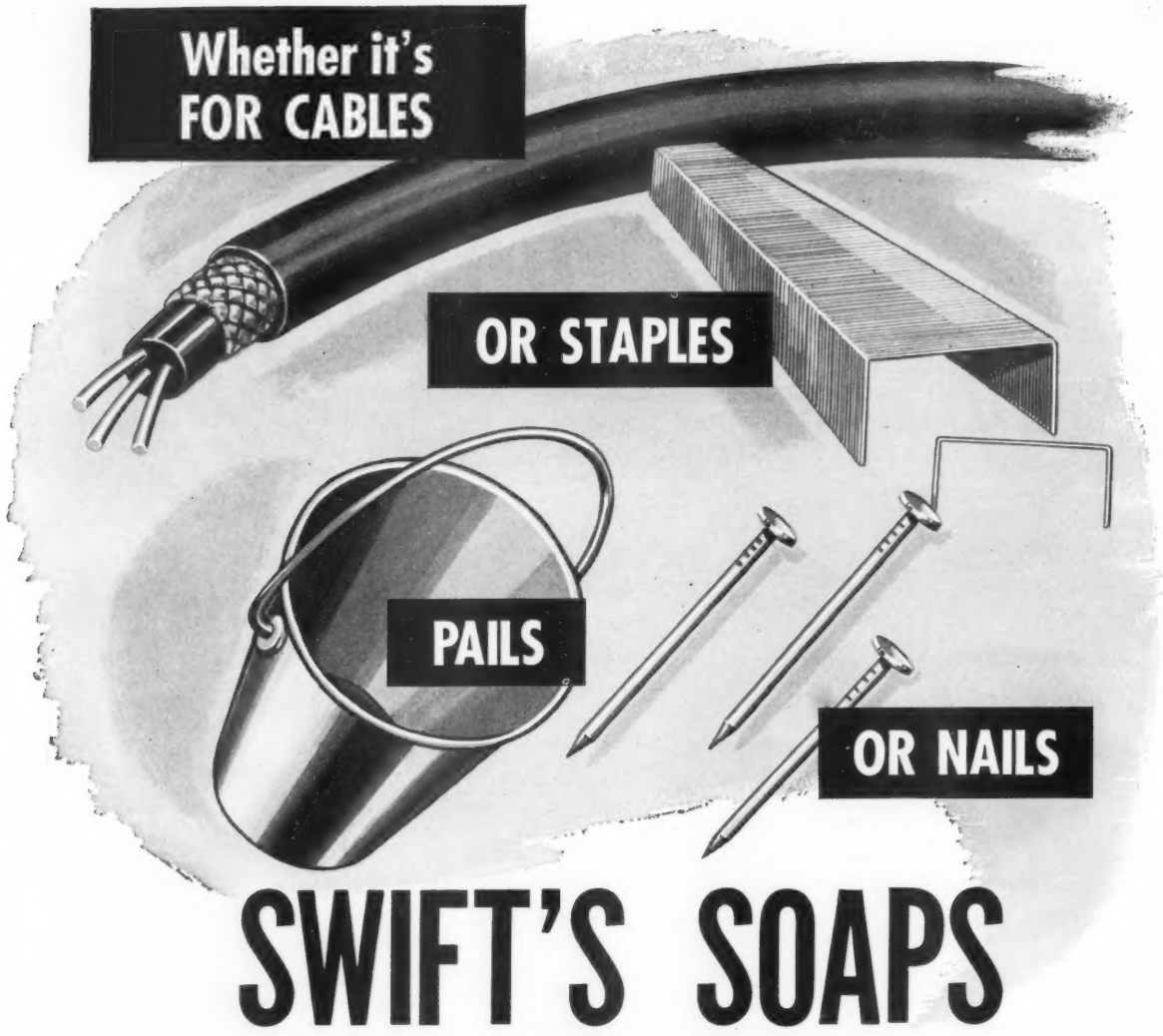
PLANTS: Harrison, N. J.
Cedartown, Ga. • Richmond, Calif.
London, Canada

SPRING CLINIC

Torrington leads the field in the development of the most advanced wire forming equipment available today. One of the reasons is Torrington's Wire Forming Laboratory, devoted exclusively to the professional springmaker's problems. This kind of close and constant study of our customers' needs has resulted in wire forming machinery tailored to meet the toughest requirements for versatile and economic production. If *you* have problems in coiling or costing, your inquiries will be classified CONFIDENTIAL!



THE
TORRINGTON
MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT
VAN NUYS, CALIFORNIA · OAKVILLE, ONTARIO



SWIFT'S SOAPS

are the efficient lubricant for wire drawing

STRATEGIC DISTRIBUTION POINTS throughout the U.S. and Canada can provide prompt, courteous service and immediate delivery on these versatile soaps:

WHITE RIBBON POWDER. White Ribbon Powder in the 41-42° titer range is used by many particular customers as an all-purpose wire drawing compound. Contains 92% anhydrous soap.

#571 HIGH TITER POWDER. A wire drawing powder for the difficult job. A neutral 93% soap powder in the titer range of 45-47° C.

#559 POWDER. For wet drawing of the fine wire products. In solution will remain fluid and completely free flowing at room temperature.

Whether the need be for cables, staples, pails, or nails an efficient wire lubricant is indispensable. That's why Swift's Soaps are constantly being improved to help give you brighter, smoother wire, increased production, and extended die life.

Yes, with any of the products listed at left, you need never compromise the efficiency and speed you purchased in wire drawing equipment. Write for details on these and other SWIFT quality wire lubricants and remember ... ONE TRIAL IS BETTER THAN A THOUSAND CLAIMS.

To Serve Your Industry Better

Swift
102 ND YEAR

SWIFT & COMPANY
SOAP DEPARTMENT
4115 Packers Ave., Chicago 9, Illinois

KEYSTONE GALVANIZED MB SPRING WIRE STUDY

KEYSTONE Galvanized MB Spring Wire exceeds Automotive Engineers' Specifications for

THE WEATHERHEAD COMPANY

Automotive engineers drew up the specifications for this wire control conduit: Must retain flexibility, resist crushing, hold lubricant and exclude dust and water even when flexed frequently, and give long, trouble-free service.

To more than meet these exacting specifications, The Weatherhead Company, Cleveland, Ohio, one of the leading manufacturers of brake hose, fittings and flexible controls, selected Keystone Galvanized MB Spring Wire.

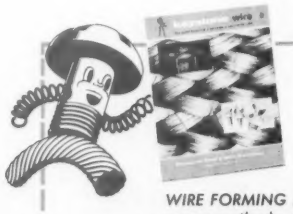
Weatherhead has found that the superior uniform tensile strength, coiling characteristics, corrosion resistance and extra strength of Keystone Galvanized MB Spring Wire produce quality flexible control cables and assure trouble-free production.

The outstanding qualities of Keystone Galvanized MB Spring Wire are the result of Keystone's exclusive method of galvanizing the wire before it is cold-drawn. The drawing process smooths and hardens the galvanized finish and improves its lasting qualities as well as its appearance.

Keystone Galvanized MB Spring Wire is furnished in Type 2 and Type 3 heavy weight zinc coatings before drawing to meet specified salt spray tests.

Do you have special wire forming problems? Keystone's metallurgical research and testing facilities are at your service. For complete details, call your Keystone representative. He's at your service.

Keystone Steel & Wire Company, Peoria 7, Illinois



KEYSTONE STEEL & WIRE COMPANY
Peoria 7, Illinois

Mail coupon for free booklet—
WIRE FORMING AND COLD HEADING FACTS! Discusses methods, technical facts, wire requirements and other data.

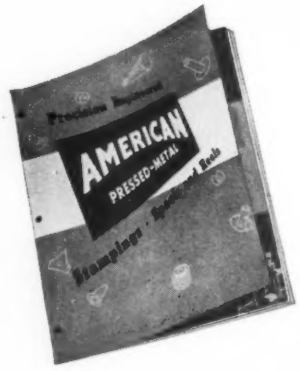
Name_____ Title_____

Company_____

Street_____

City_____ State_____

KEYSTONE
WIRE FOR INDUSTRY



Send for your free copy of our latest bulletin on American Pressed-Metal Spools and Reels. It contains full details and charts on the many standard types.

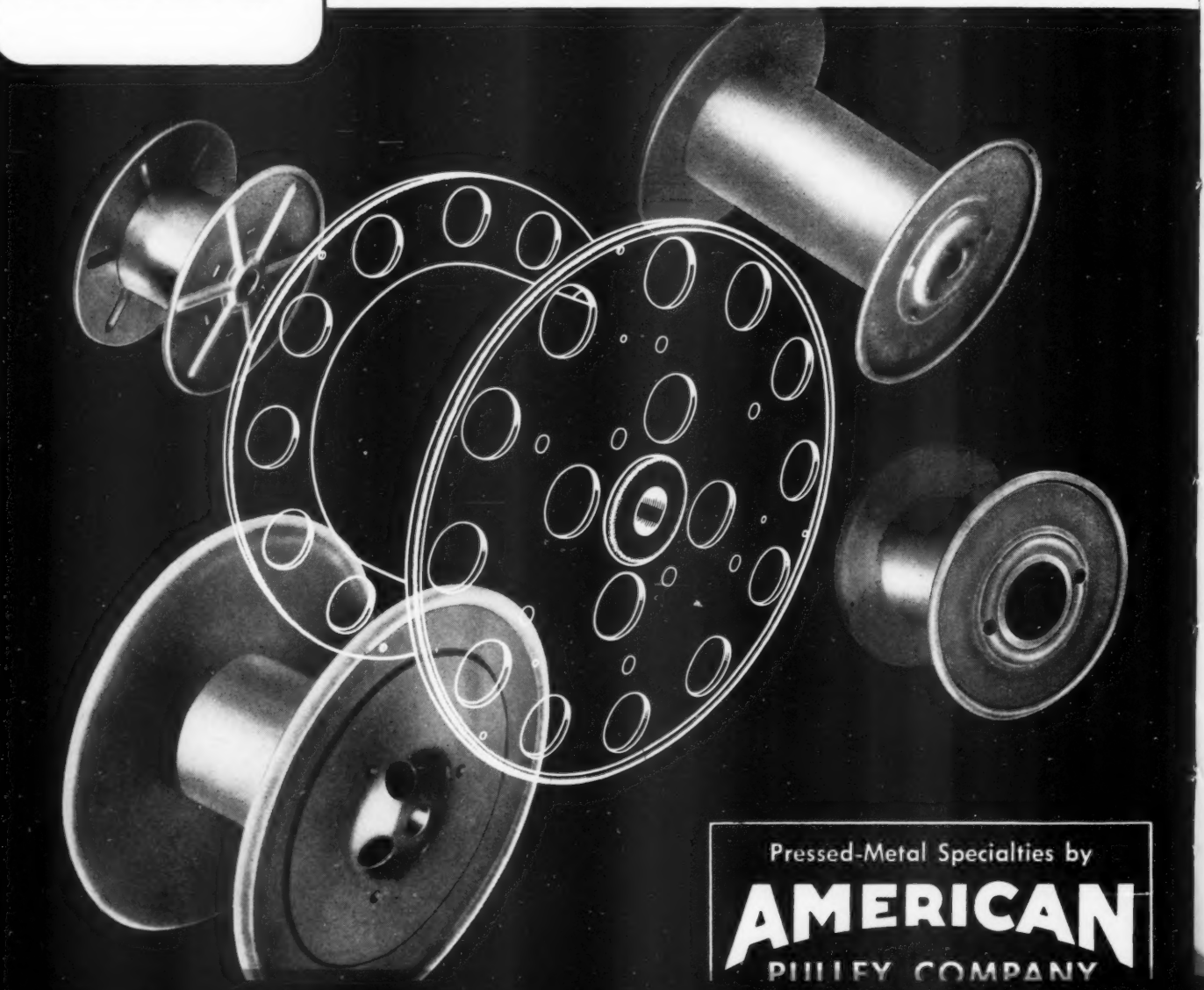
For shipping or processing spools and reels get exactly what you want from American Pulley

Name your need . . . there's an American pressed-metal reel or spool to meet it. And if our long list of standard sizes doesn't contain the model you need, we'll custom-build one to your exact requirements.

American pressed-metal spools and reels are practically indestructible—won't crack, chip or warp. They offer the added advantages of light weight, cleanliness and strength.

Almost 60 years' experience in design and manufacture—plus a vast assortment of tools, dies and other facilities for making all types of spools and reels to strict custom specifications—are at your service.

Send us your specifications, blueprints or merely tell us what you need and we'll design from scratch. You'll find our quotations fast, realistic and offering you good value for the money. The American Pulley Company, 4242 Wissahickon Ave., Philadelphia 29, Pa.



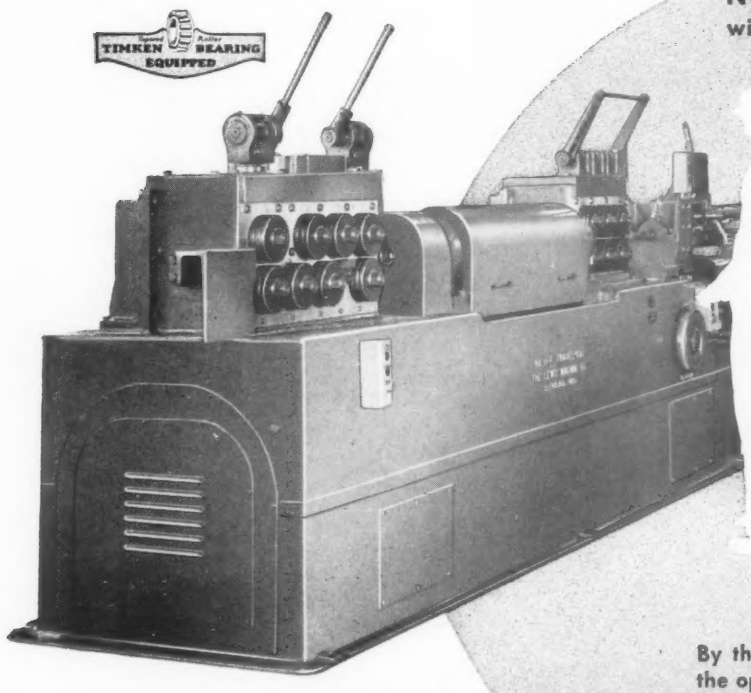
Pressed-Metal Specialties by

AMERICAN

PULLEY COMPANY

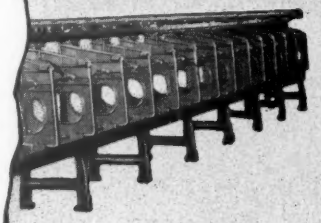
LEWIS

Machines can solve any wire straightening or cutting problems



No. 11-F TRAVEL-CUT
with special extension

This machine was engineered to meet special requirements for custom cutting a wide variety of concrete reinforcing bars up to 50 feet in length



SINGLE STATION OPERATION

eliminates waste time and fatigue by placing operator at one position

Lewis Travel-Cut Machines are available with air clutch and brake and variable speed drive.

By the simple movement of a lever the operator can set the electric limit switch to cut any desired length from 6 to 50 feet. A dial graduated in feet and inches tells him the exact length the machine will cut. A preset counting device stops the machine when the proper number of pieces is cut.

Any predetermined number of pieces may be cut with this equipment to any predetermined length without the operator moving from his regular position at the machine.

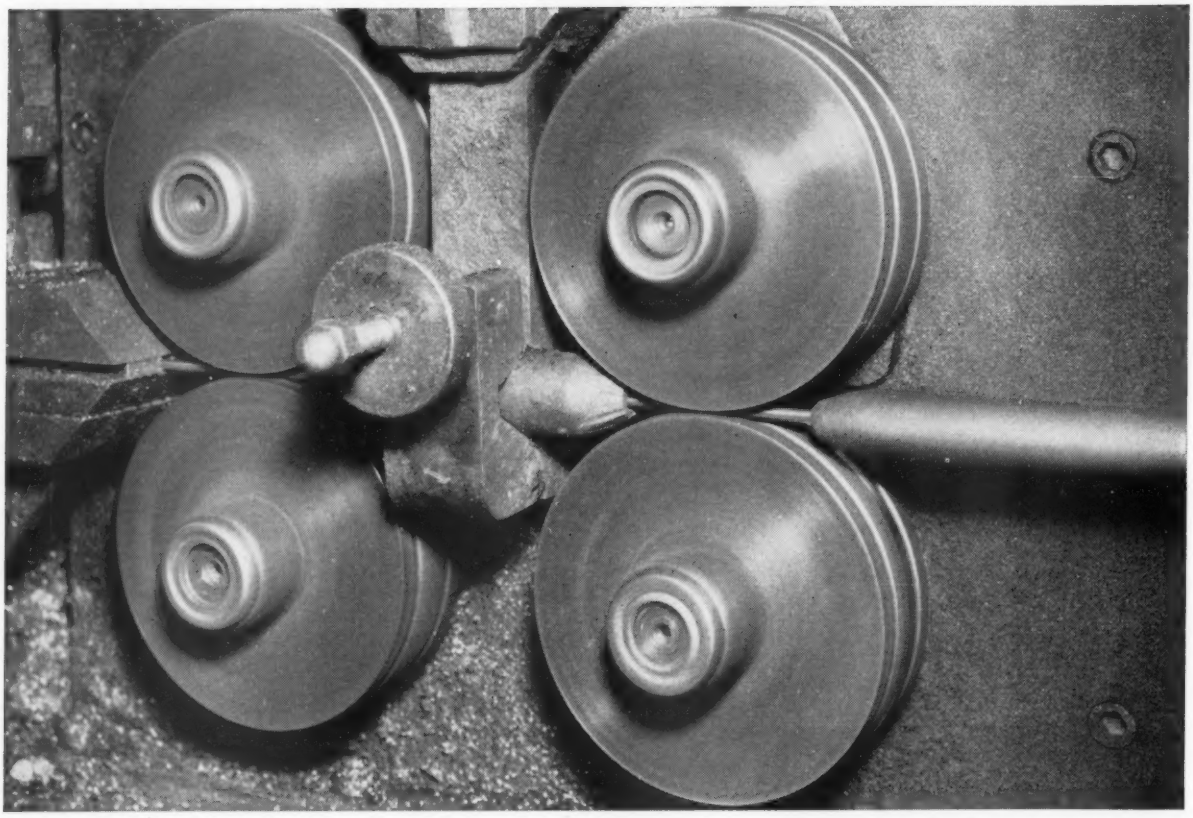
There is a Lewis Machine design to straighten and cut all materials and shapes in wire and or bar stock from .012″ to ¾″ diameter at a wide range of speeds. If you have a wire straightening and cutting problem, or special requirements for a job, ask us for information and suggestions about how Lewis Machines can increase your production, control your quality and greatly reduce your costs.

New illustrated brochure available on request.

THE LEWIS MACHINE COMPANY

3441 East 76th Street • Cleveland 27, Ohio, U.S.A.

76 MILLION welding rods through these **CROMOVAN** feed rolls!



36 months service and still going strong!

CROMOVAN, a Firth Sterling air hardening, high carbon – high chrome die steel is a terrific performer in wear and abrasion resistance applications.

For example, carbon steel feed rolls at Marquette Manufacturing Company, Minneapolis, lasted only seven months even when serviced constantly, but CROMOVAN replacements are still going strong after 36 months of grueling use and *no* servicing! Four feed rolls guide 14″ welding rods (stainless, carbon, and alloy steel) into a flux coating machine at 700 ft. per minute and 76,000,000 rods passed through them with only .022″ groove wear and *no down time* for redressing.

You, too, can realize comparable savings, reduced maintenance, and higher production when you adopt CROMOVAN for feed rolls, guides and wear parts. Write for Technical Bulletin 20-010 or 20-011 (Free Machining), today.

Mr. Tooley says–

"Firth Sterling offers the advantage of a single source of supply for both tungsten carbides and high grade tool and die steels for every shop tooling purpose. Because we have *both* you get *unbiased* recommendations."

R-318

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON, HARTFORD
OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND* DAYTON DETROIT* HARTFORD* HOUSTON* LOS ANGELES* PITTSBURGH WESTFIELD ,N.J

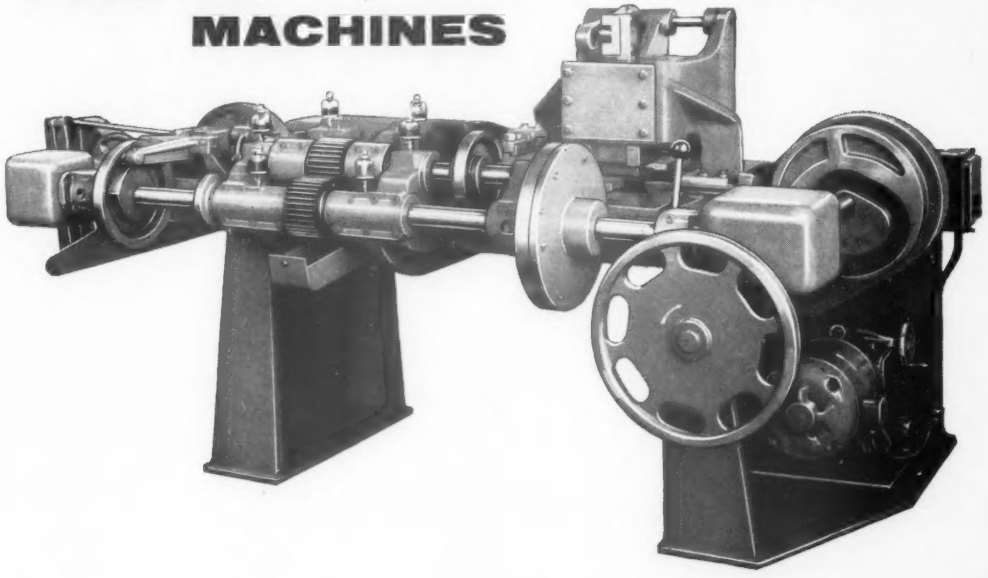
PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

VISIT OUR BOOTH NO. 937-A — WESTERN METALS SHOW, LOS ANGELES

...ask BAIRD about it

NEW Ribbon Metal MACHINES



Open UNEXPLORED opportunities for cost reduction in manufacture of a wide range of parts.

- HIGH SPEED
- UNIFORM PRODUCT
- LOW TOOLING COST
- EASY MAINTENANCE
- SIMPLE OPERATION
- UNLIMITED RANGE

If you are producing small . . . or even quite large . . . formed parts out of ribbon wire or metal strip up to about 2″ wide, it will most certainly pay you to "ask Baird about it." More and more quality and cost-conscious manufacturers are finding that our NEW model Automatic High Speed Ribbon Metal Forming Machines are the ideal "production line" for such products.

Behind these machines are years of successful application to a range of work "limited only by the ingenuity of the men who design the tooling." NEW models include a host of important improvements and additional features which greatly extend the range of work and tooling possibilities. For example, what is essentially a substantial press is built right into the machine and is capable of maintaining precision in high-speed production. Baird's unique two-to-one feeding mechanism and EASY cam motions, combined with the fact that 3/4 of the cycle is available for forming rather than the usual 1/2-cycle, permits far greater latitude in combining operations and complexity of possible forms.

Our Engineering Department will be glad to give you further detailed information or to submit recommendations on parts or prints of your product. Write Dept. WP.

Interested in Deferred Payment? . . . "ask Baird about it."

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

7BA56

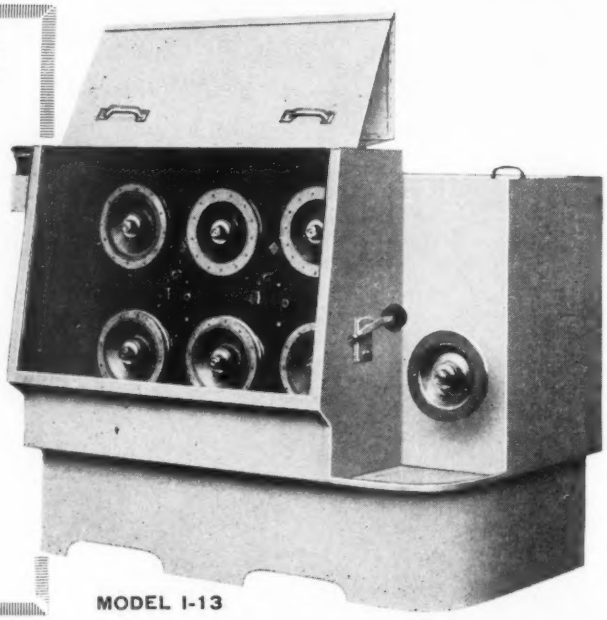
designed by COOK MFG. CO. *"draws out the best in wire"*

INTERMEDIATE WIRE DRAWING MACHINE

specifications:

Maximum Size of Entering Rod	#8 B&S Gauge
Finished Wire Size	#18 to 26 B&S Gauge
Maximum Operating Speed	5,000 ft./minute
Maximum Number of Dies	13
Number of Drawing Blocks	6
Maximum Size of Die Case	1½" dia. x 1" thick
Spool Capacity	500 to 1,000 lbs.
Spool Traverse	11"
Spool Diameter	30"
Motor Size	75 HP

- All welded construction and built of heavy steel plate (as is all Cook Equipment). Conveniently arranged dies permit quick and easy string-up. Main drive motor is coupled to machine.

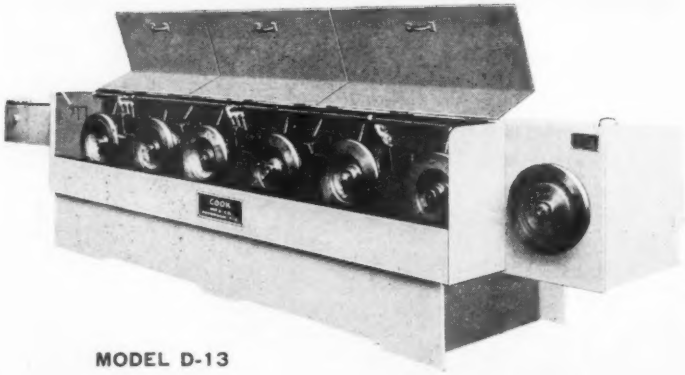


MODEL I-13

The COOK Heavy Duty Rod Breakdown Machine, Model D-13

specifications:

Maximum Size of Entering Rod	5/16" Copper 3/8" Aluminum
Finished Wire Size	#8 to 16 B&S Gauge
Maximum Operating Speed	5,000 ft./minute
Maximum Number of Dies	13
Number of Drawing Blocks	6
Maximum Size of Die Case	1½" dia. x 1" thick
Spool Capacity	1,000 lbs.
Spool Traverse	11"
Spool Diameter	30"
Motor Size (maximum)	200 HP



MODEL D-13

- **Our Engineering Dept. is at your service to assist you in the solution of your wire problems—at no obligation of course.**

A Complete Line of Quality Machinery For The Wire and Cable Industry To Meet Rigid Specifications.

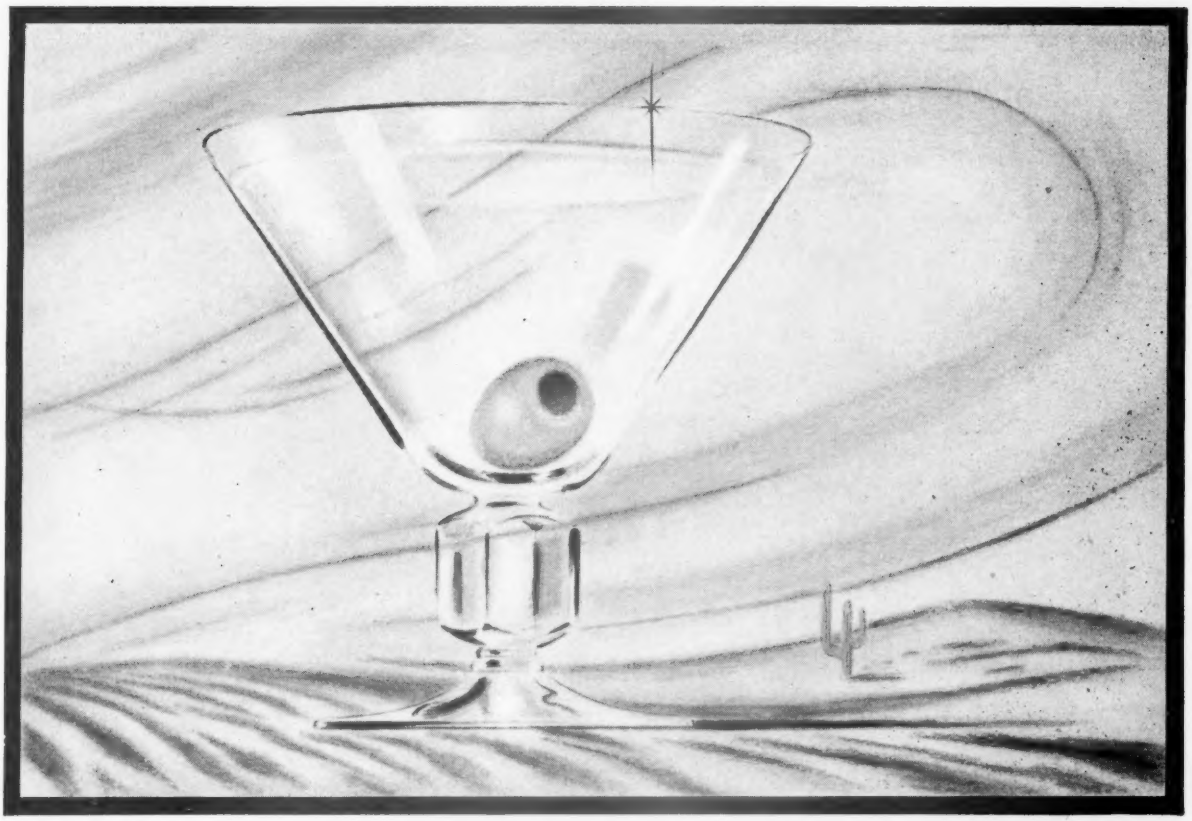
COOK MANUFACTURING CO.

50 EAST 25TH STREET, PATERSON, N. J. • ARMORY 4-6380

CANADIAN AGENT:
E. V. LARSON CO., LTD.
TORONTO CANADA

EUROPEAN AGENT:
CAPAMADJIAN LE MONNIER CIE LTD.
PARIS FRANCE

Naugatuck NAUGAPOLS



dry!

and they stay dry!

SPECIALLY PROCESSED for *low moisture absorption!* That's why Naugatuck Chemical's NAUGAPOLS® offer you 5 big advantages over ordinary grades of butadiene-styrene (R-S type) synthetic rubber. Special processing during transformation from the liquid copolymer state produces elastomers characterized by:

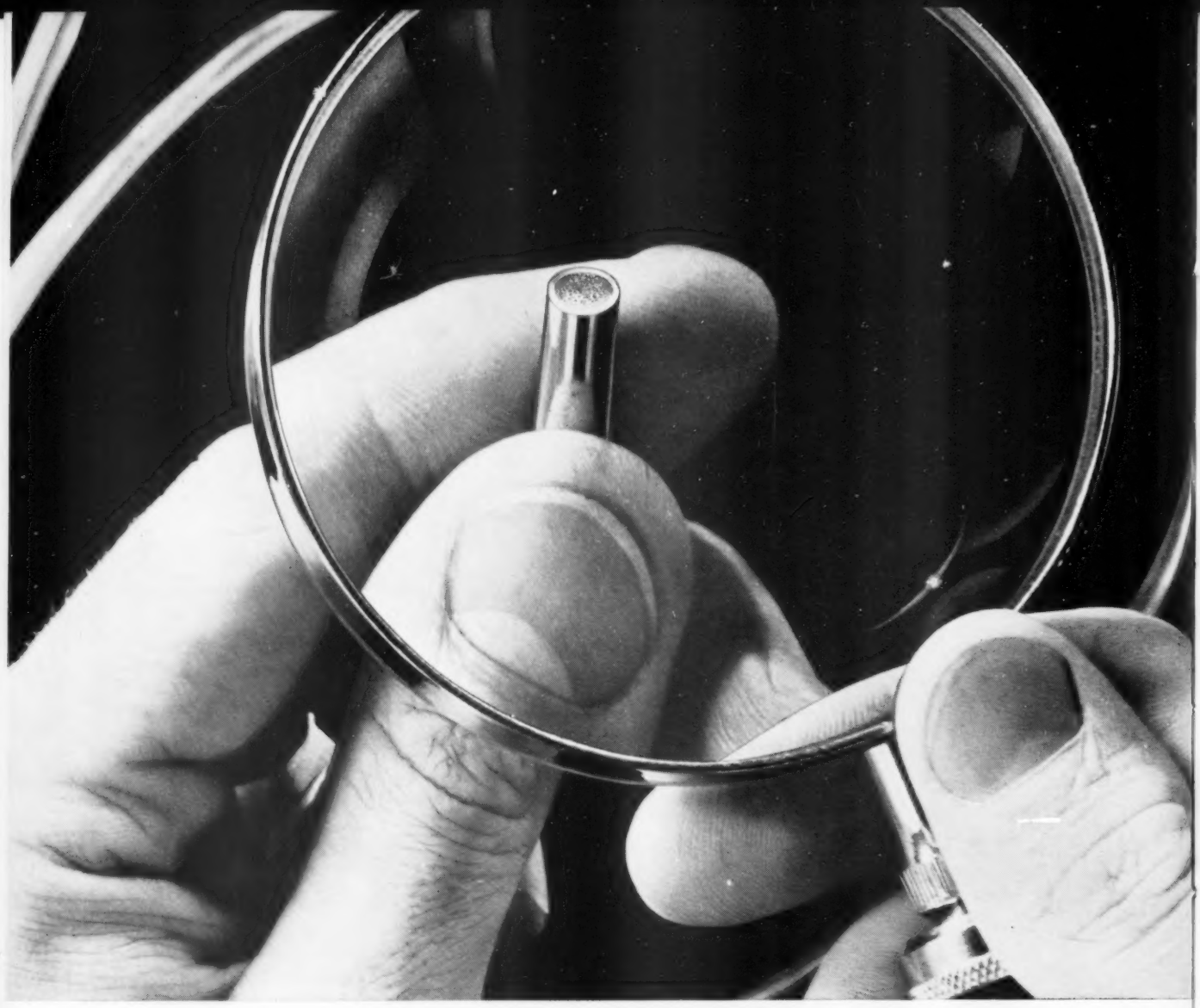
- **VERY LOW MOISTURE ABSORPTION**
- **EXTREME CLEANLINESS AND UNIFORMITY**
- **HIGH DIELECTRIC PROPERTIES**
- **LOW ASH CONTENT**
- **EASY SUBSEQUENT PROCESSING**

That's why NAUGAPOLS are so definitely preferred by manufacturers of rubber-insulated wire and cable...and by the makers of specialty mechanical rubber products. If *you* require special grades or special properties in synthetic rubber, let us help you solve your particular problem.

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

IN CANADA: NAUGATUCK CHEMICALS DIVISION • Dominion Rubber Company, Limited, Elmira, Ontario • Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N.Y.



UNIQUE COPPERPLY® WIRE . . . *unique advantages!*

● National-Standard Copperply is unique because its heavy copper jacket is bonded to a steel wire core by a continuous *electroplating* process. This results in precise concentricity and permits closely controlled coating thickness. It also permits the use of core steels in a wide range of analyses.

The coating is so uniform and the bond so permanent that Copperply can be twisted, bent, flattened, stranded, woven or even roll-threaded without the slightest danger of rupturing the coating or otherwise exposing the core. Thus Copperply's extreme uniformity and permanence mean prolonged service life and maximum protection against rust, regardless of forming or service requirements.

The uses for this unique new wire are many. They range from high strength communications line and electronic applications to wire for non-rust masonry ties and decorative jewelry chain—*wherever* the combined qualities of copper and steel can work to advantage.

Name the use you have in mind and let National-Standard help you work out details. It's part of our unusual service.

NATIONAL NS NATIONAL-STANDARD Company NILES, MICHIGAN **STANDARD**

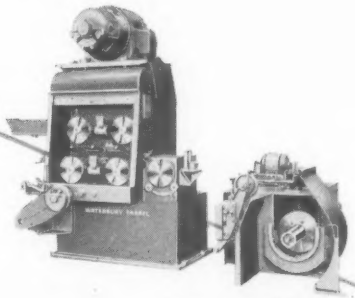
DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires* • WORCESTER WIRE WORKS, Worcester, Mass.; *high and low carbon specialty wires*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • ATHENIA STEEL, Clifton, N. J.; *flat, high carbon spring steels* • REYNOLDS WIRE, Dixon, Ill.; *industrial wire cloth*

Over 60 Years Of Broad Experience As A . . .

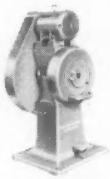
SOURCE OF SUCCESSFUL WIRE MILL EQUIPMENT

WATERBURY FARREL
FOUNDED 1851

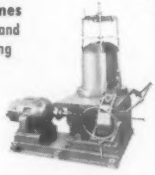
String-Up Machines with Roll Pointers and Hand Swagers



Upright Cone Wire Drawing Machines
For Intermediate and Fine Wire Drawing



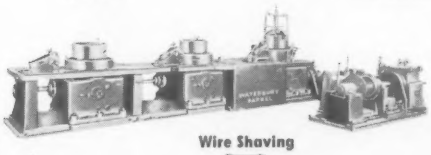
Rotary Swagers



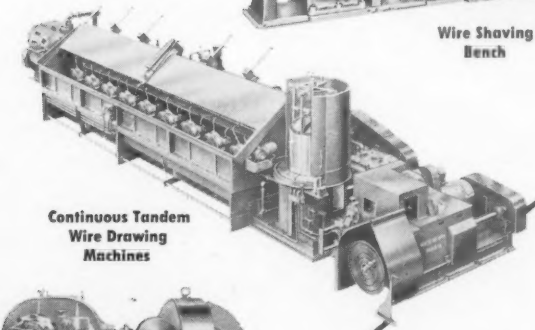
Vertical Bull Blocks

Horizontal Swagers

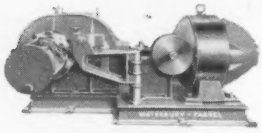
WF-35



Wire Shaving Bench



Continuous Tandem Wire Drawing Machines



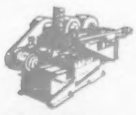
Horizontal Bull Blocks

Write for free bulletins on the specific types of machines you are interested in.

- BULL BLOCKS
- CONTINUOUS TANDEM WIRE DRAWING MACHINES
- HAND SWAGERS
- HORIZONTAL SWAGERS
- ROLL POINTING MACHINES
- ROTARY SWAGERS
- SLEEVE WIRE DRAWING MACHINES
- SPOOLERS
- STRING-UP MACHINES
- TRAVERSING WINDERS FOR FLAT WIRE
- UPRIGHT CONE WIRE DRAWING MACHINES
- WIRE FLATTENING MILLS
- WIRE SHAVING BENCHES

WATERBURY FARREL

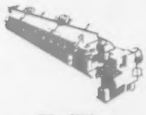
THE WATERBURY FARREL FOUNDRY & MACHINE CO.
Waterbury, Conn., U. S. A.
Branch Offices: Chicago • Cleveland • Millburn, N. J.



Bolt, Nut & Screw Machinery

Power Presses

Rolling Mill Machinery



Wire Mill Equipment

Sendzimir Mills and Other Special Machinery

Frogs and Florists

Florists keep flowers in place by sticking the stems into the sharp pins of a florist frog—sharp pins that are often made from hard drawn, low carbon CF&I-Wickwire Pin Wire which is free from scratches and other surface imperfections.

Chances are you don't need wire to make florist frogs. But *you may need one or more of the nearly 100 different categories of specialty wire for which CF&I-Wickwire is famous.* Let us show you how we can meet your most rigid chemical and physical specifications on high and low carbon wire in all sizes, shapes, tempers, finishes and grades.

Check This List!

FOR THE WIRE YOU REQUIRE, SEE CF&I-WICKWIRE.

FLAT AND SHAPED WIRES
Armor Wire
Bobby Pin Wire
Bookbinder Wire
Brush Wire
Casing Wire
Cotter Pin Wire
Curtain Spring Wire
Die Spring Wire
Gutter Broom Wire
Lock Spring Steel
Rake Tine Steel
Regulator Spring Wire
Snake Fishing Steel
Stapling Wire for Preformed Staples (Flat)

LOW CARBON FINE AND SPECIALTY WIRE
Bee Wire
Bonnet Wire
Bookbinder Wire
Broom Wire
Clip Wire
Dent Spacer Wire
Drapery Pin Wire
Florist Wire
Fuse Wire
Glass Netting Wire
Hairpin Wire
Hook and Eye Wire
Mattress Wire
Picture Cord Wire
Picker Tooth Wire
Pin Ticket Wire
Pin Wire
Ring Traveller Wire
Spiral Binding Wire
Stapling Wire
Stapling Wire for Preformed Staples
Stone Wire
Weaving Wire
Weaving Wire for Fly Screen Cloth
Wissco Iron Wire

HIGH CARBON FINE AND SPECIALTY WIRE
Aircraft Cord Wire
Armor Wire
Belt Hook Wire
Bobbin Ring Wire
Brush Wire (Tempered and Untempered)
Brush Wire (High Strain)
Chrome Vanadium Spring Wire
Core Wire (Aluminum Cable Steel Reinforced)
Curtain Spring Wire
Flexible Shaft Wire
"Gamma" Spring Wire (Upholstery Spring Wire)
Zig Zag Wire
No-Sag Wire
Hat Wire
Heddle Wire
Hose Reinforcement Wire
Hose Wire, Mechanical
Hose Wire, Vacuum and Defroster
Rope Wire
Signal Corps Wire
Spoke Wire
Hard Drawn Spring Wire
Oil Tempered Wire
Spheroidized or Annealed Spring Wire
Tire Bead Wire
Valve Spring Wire

MANUFACTURERS LOW CARBON COARSE WIRE
Bag Tie Wire
Basket Handle Wire
Box Binding Wire
Brush Handle Wire
"Cal-Tie" Wire
Can Key Wire
Case Hardened Ball Wire
Chain Wire
Clamp Wire
Clothes Pin Wire
Concrete Wall Reinforcement Wire
Garment Hanger Wire
Hay Baling Wire (Coiled)
Lingo Wire
Lintel Wire
Loop Wire
Merchant Quality Wire
Pail Bail Wire
Rivet Wire
Stapling Wire
Strand Wire
Tying Wire
Welding Wire
Wissco Iron Wire
Industrial Quality Wire
Cold Rolling Quality Wire
Heading, Forging or Roll Threading Quality Wire
Medium High Carbon Wire

CF&I-WICKWIRE WIRE

THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Casper Denver • El Paso • Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Oklahoma City • Phoenix Pueblo • Salt Lake City • Wichita • PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland San Francisco • Seattle • Spokane • WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo Chicago • Detroit • New Orleans • New York • Philadelphia • CF&I OFFICE IN CANADA: Toronto
CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg

CF&I

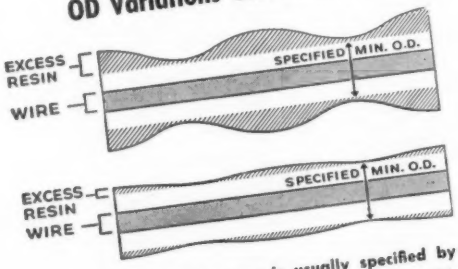
4242

U.S.I. POLYETHYLENE PROCESSING TIPS

Choose the Right Resin For Polyethylene Wire Coating

Now that polyethylene is being widely accepted as an insulating material for wire and cable, insulated wire manufacturers and plastics producers are working closely together to provide the best insulations at the lowest possible cost. Although the only true test of a given polyethylene resin is a test run followed by a thorough evaluation of the finished wire, there are certain principles that can be used beforehand as guides. For example:

OD Variations Cost Money



Minimum Outside Diameter is usually specified by the wire customer. But a variation in OD above this minimum uses extra quantities of polyethylene resin — and cuts into extruder profits. These variations can be reduced by using resins with consistant flow characteristics as shown in the lower sketch.

Higher Production Rate Means Higher Profit

The faster a machine can be operated, the more money it can make. But higher rates require tighter controls — especially tighter control of resin properties. A resin variation that might still give a satisfactory product at moderate production rates may not be acceptable when the extruding rate is pushed to its limit. Again, consistency of resin properties is of extreme importance.

Final Properties Are All-Important

Deformation under load, stress-cracking, low-temperature brittleness and spark failure must be kept to a minimum in an acceptable wire and cable insulation. Any resin used, no matter what its processing characteristics, must pass these tests.

Why We Recommend PETROTHENE®

Because we make it — of course. But more than that, PETROTHENE does a good job for wire and cable extruders because our manufacturing process does achieve the high consistency processors are looking for. Shipment-to-shipment, bag-to-bag, and cube-to-cube, variations are held to a minimum. This high consistency enables insulated wire manufacturers to operate at highest rates with minimum OD variation when using PETROTHENE electrical grade polyethylene resins.

PETROTHENE resin properties also measure up to end-use standards for deformation under load, stress-crack resistance, low-temperature brittleness and spark failure.

Three Basic Resins Are Available

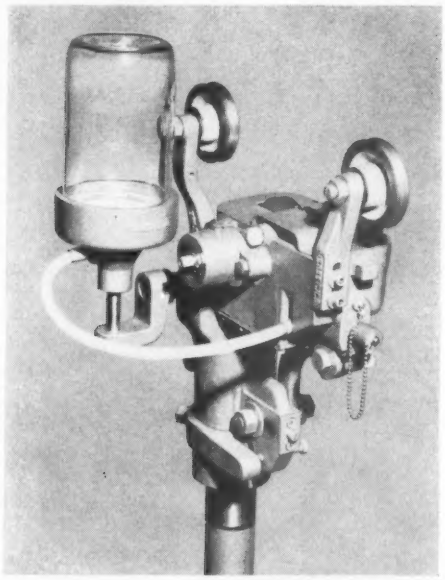
PETROTHENE 300, M.I. = 0.3; PETROTHENE 301, M.I. = 1.0; PETROTHENE 302, M.I. = 2.8. Each available with carbon black, color, JZF antioxidant, and/or non-discoloring antioxidant, compounded to your specifications.

U.S.I. Services

Literature and samples of PETROTHENE electrical grade polyethylene resins are available at your request. U.S.I. Technical Service representatives are also ready to help you with individual processing problems.

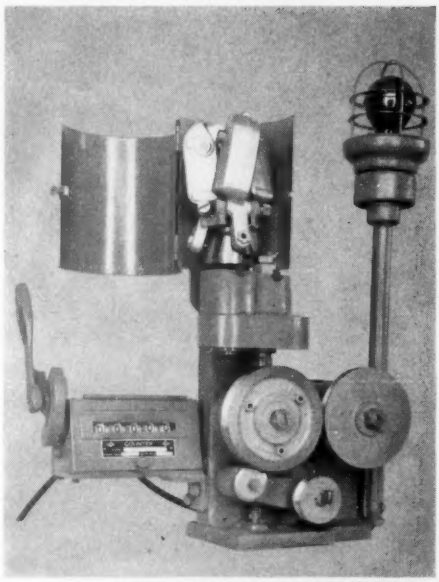
U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

NOW — MARKING MACHINES, WHEELS, TYPE STRIPS, INKS



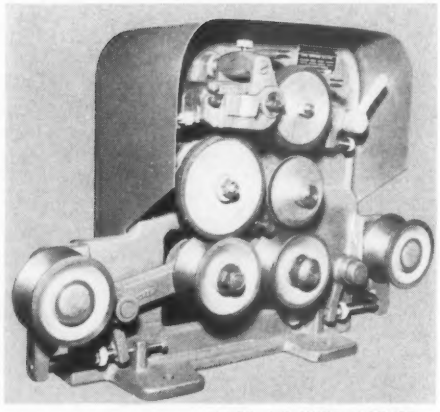
TYPE F WIRE MARKER

AVAILABLE FROM ONE SOURCE



TYPE G SPIRAL MARKING MACHINE

ENTWISTLE OFFERS COMPLETE RANGE OF MARKING DEVICES TO INDIVIDUAL SPECIFICATIONS FOR BOTH RUBBER AND THERMOPLASTIC INSULATION



TYPE A-2 WIRE MARKER

WHEELS — TYPE STRIPS

By making all marking machines and supplies available from one source, Entwistle helps simplify your ordering, makes it easier, speeds delivery. Machines can be ordered to meet your specific production problems and requirements. Printing size marks, codes, trademarks, etc. or spiral striping of wire can be done without slowing production.

TYPE F WIRE MARKER Prints or stripes on plastic wire using only one revolving printing member. Prints at extruder wire speed, eliminates re-reeling for printing.

TYPE G SPIRAL MARKING MACHINE Spiral stripes up to three different colors simultaneously. Rotated by passage of wire. Capacity from 3/64 to .20 inches wire diameter. Capacity to 5/16″ diameter can also be provided.

TYPE A-2 WIRE MARKER Prints or stripes wire and tubing. Operated by movement of wire. Prints in one color. Type strip legend made to your requirements. They provide trouble-free operation and are readily interchangeable.

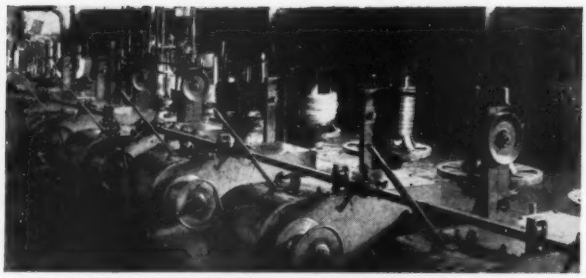
WHEELS — TYPE STRIPS Marking wheels are of chrome plated steel. Each is etched to customer's specifications. Inexpensive, economical type strips are of durable rubber bonded to a flexible steel band.

WIRE MARKING INKS Permanent, scuff-proof, resistant-proof. Will pass all present abrasion and solvent resistance tests. Available in all seven standard colors. Mixed to match your specific shades at no extra cost.

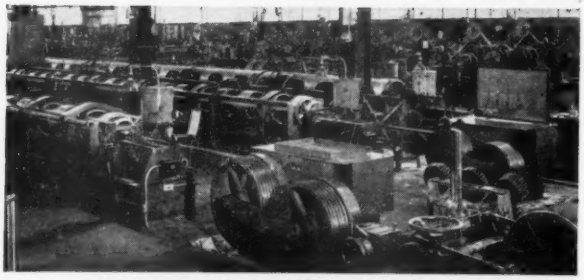
For complete details on inks and machines above, write or phone direct.

ENTWISTLE
Manufacturing Corporation

1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND



SPOOLING OPERATION—Coils of Youngstown Wire are placed on winches from which the wire passes over a sheave and guide onto the bobbin in the foreground.



STRANDING OPERATION—Filled bobbins are placed in the stranding machines for forming the individual wires into strands. In these machines from 7 to 41 bobbins are placed, all wires emerging at the forward end being formed into a single strand which passes over the draw works and onto the larger bobbin shown at right.

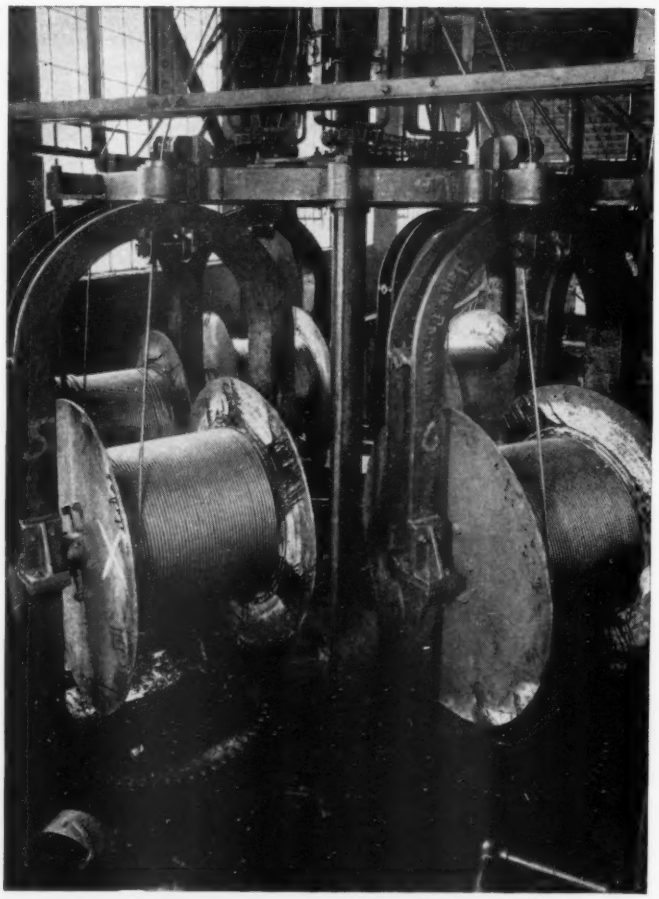
YOUNGSTOWN "YOLECTRO" ROPE WIRE

. . . helps maintain high quality of Broderick Bascom Yellow Strand wire rope

For over half-a-century Broderick & Bascom Yellow Strand wire rope has enjoyed a world-wide reputation for excellence of both workmanship and finished product. To maintain their high quality standards, they use Youngstown "Yolectro" High Carbon Rope Wire as the basic material in the production of their various brands of wire rope. They have found over the years that it offers the required toughness and strength, abrasion resistance, gage uniformity, and flexibility to guarantee a Broderick & Bascom product of consistent quality.

"Yolectro" High Carbon Rope Wire is quality-controlled to provide the correct balance of properties to meet your most critical requirements. Why not make it your specification for quality production? It's available in both Bright and Galvanized finishes in all high carbon grades.

Metallurgical assistance or additional information may be received from your nearest Youngstown District Sales Office. Why not write or phone today?



CLOSING OPERATION—In this machine, six finished strands are formed around a center core of either fiber or independent wire rope.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

QUALITY YOUNGSTOWN SERVICE

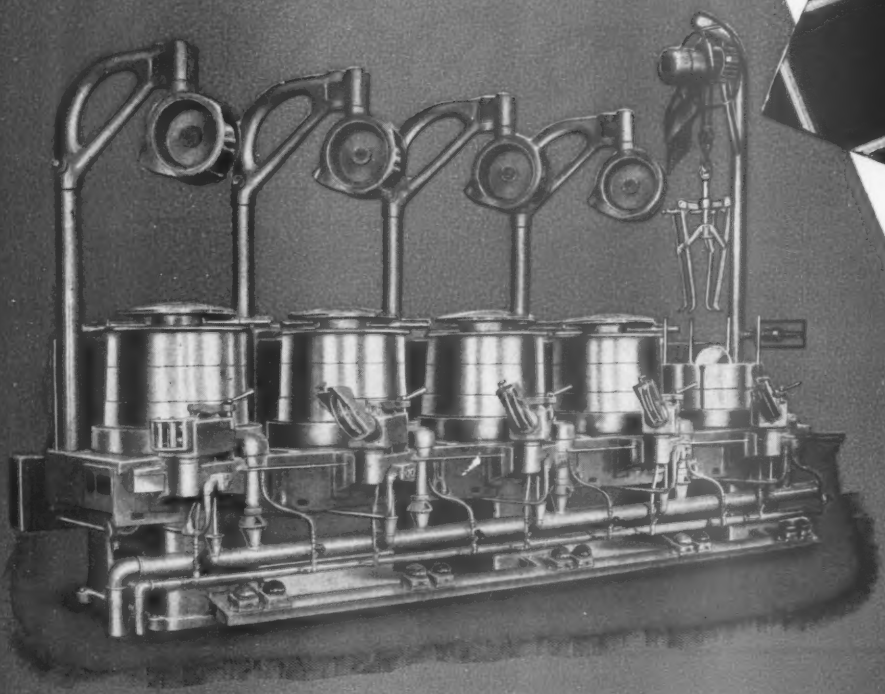
Producers of Quality Carbon and Alloy Steels for Over Half-a-Century

HERBORN

Non-Slip
Continuous

Wire Drawing Machines

For Low Carbon and
High Carbon Steel Wire



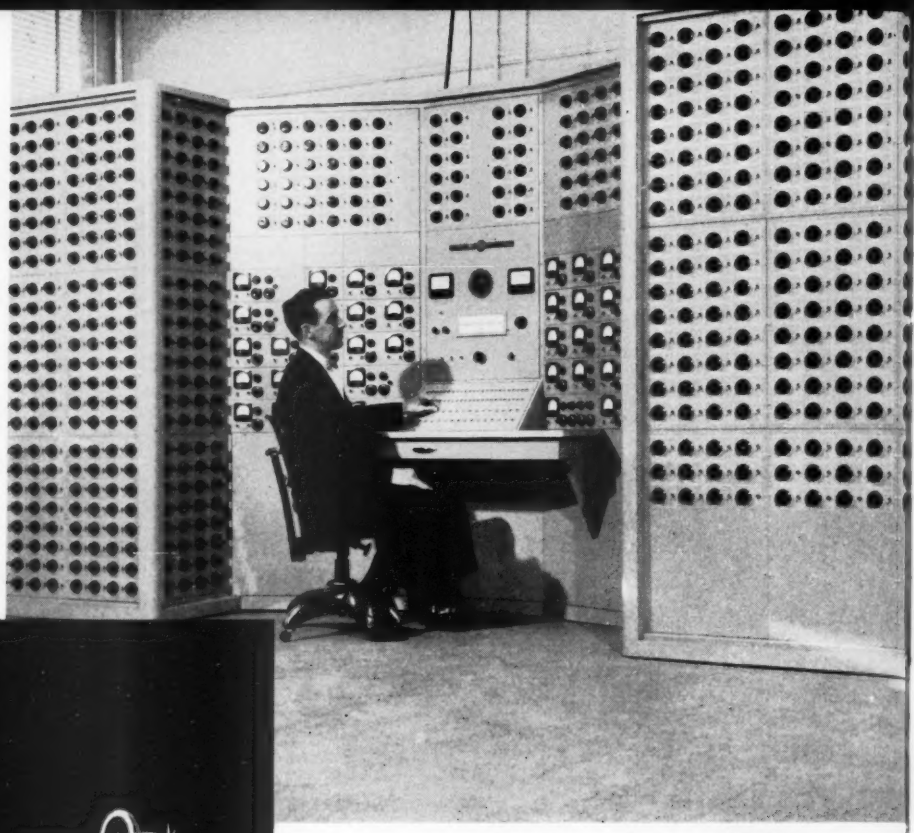
Please send your inquiries to

MASCHINENFABRIK HERBORN BERKENHOFF & DREBES A.-G. **HERBORN/DILLKREIS** GERMANY

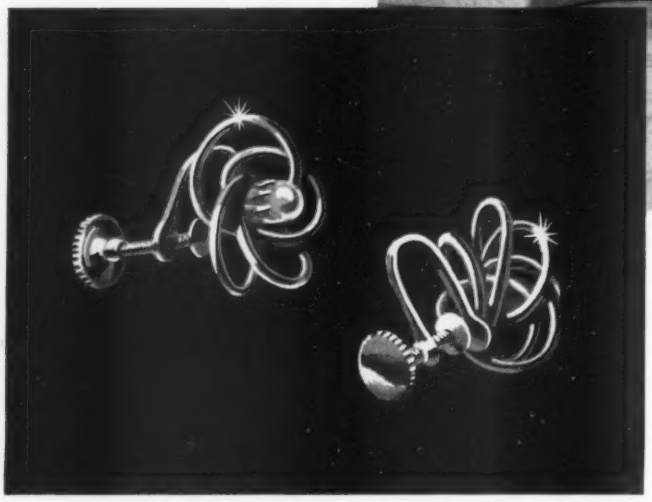
Sole Representative in the U. S. A.:

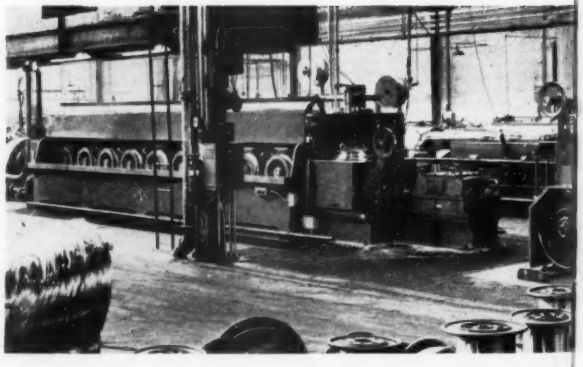
KURT ORBAN CO., Inc., 34 Exchange Place, JERSEY CITY 2, N. J.

FROM ELECTRONIC COMPUTERS TO EARRINGS



devaney





Essential to both earrings and computers is wire.

Wire is as common a world denominator as you can find — everywhere miles of wire help perform the large and small tasks of the world's business.

In the designing and building of efficient wire drawing machinery, SYNCRO is pre-eminent. SYNCRO know-how has always successfully met all challenges, and SYNCRO alertness continuously seeks more. Continuous forward advances in design and performance keep SYNCRO's customers happy and gain new ones.

If you seek to know the latest — look to SYNCRO first.

SYNCRO®

SYNCRO MACHINE COMPANY

Perth Amboy, New Jersey, U.S.A.

affiliated company: WINGET SYNCRO Ltd. Rochester Kent, England

Better Machinery for the Wire Industry

WIRE DRAWING MACHINES • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY

if you're Metalizing Aluminum ...boost efficiency, productivity with

UNITED ALUMINUM WIRE

With the right materials, metalizing or spray wire can be a tremendously successful production and maintenance operation. When metalizing aluminum, for example, efficiency and productivity go way up when gun feeds rich, pure United Aluminum Wire.

Chemically clean surface finish, uniform size, purity and kink-free coiling are the reasons why. United aluminum wire is commercially pure 1000 grade. Through rigid statistical quality control, every inch is drawn to accurate size and tolerance. United Aluminum Wire, the result of years of experience in this field, meets U. S. Government, A. S. T. A., and all other accepted standards.

Common sizes, 1/8" and 3/16", are shipped promptly. Other sizes also available. Same high quality is also available in copper and copper alloys.

For full information, write, wire or phone.

VISIT BOOTH 305, AWS WELDING SHOW, APRIL 9-11, 1957
CONVENTION HALL, PHILADELPHIA, PA.

Proximity Limited
UNITED WIRE AND SUPPLY CORPORATION
PROVIDENCE 7, RHODE ISLAND

ALUMINUM • BRASS • COPPER • WIRE AND TUBING • BRAZING PRODUCTS • PHOSON • SILBOND

Coming Soon . . .

THE CANADIAN REGIONAL MEETING

May 13-14, 1957 — Royal Connaught Hotel — Hamilton, Ontario, Canada

The Program Committee has announced the papers to be given, as follows:

"Rod Packaging" by J. S. Laver, Manager of Production Scheduling, Steel Company of Canada Ltd., Hamilton.

"Some Aspects of Quality Control" by G. Globe, B. Greening Wire Co., Hamilton.

"The Value of Rimmed, Capped and Killed Steels for Wire Rods" by Ralph Hindson, Asst. Chief Metallurgist, Steel Company of Canada, Ltd., Hamilton Works, Hamilton.

Royal Connaught Hotel

"Stainless Steel Spring Wire" by J. Trent, Cold Drawing Dept., Atlas Steels Ltd., Welland, Ont.

"Aluminum Magnet Wire" by G. J. Moher, Process Engineer, Canadian General Electric Co. Ltd., Peterborough, Ont.

AND "Metals in Communication and Power Transmission" (tentative title) by Dan Boyd, Metallurgical Department, Cable Engineering Laboratories, Wire and Cable Division, Northern Electric Co. Ltd., Lachine, Que., Canada.

Plant Inspection Tours

Plans have been made for plant visits to the Parkdale Works of The Steel Company of Canada in Hamilton and the Federal Wire and Cable Company at Guelph, Ontario.

Other Features

On Monday evening, May 13th, there will be a banquet at the Hotel, preceded by a cocktail hour. Ladies accompanying their menfolk will be welcome at the banquet.

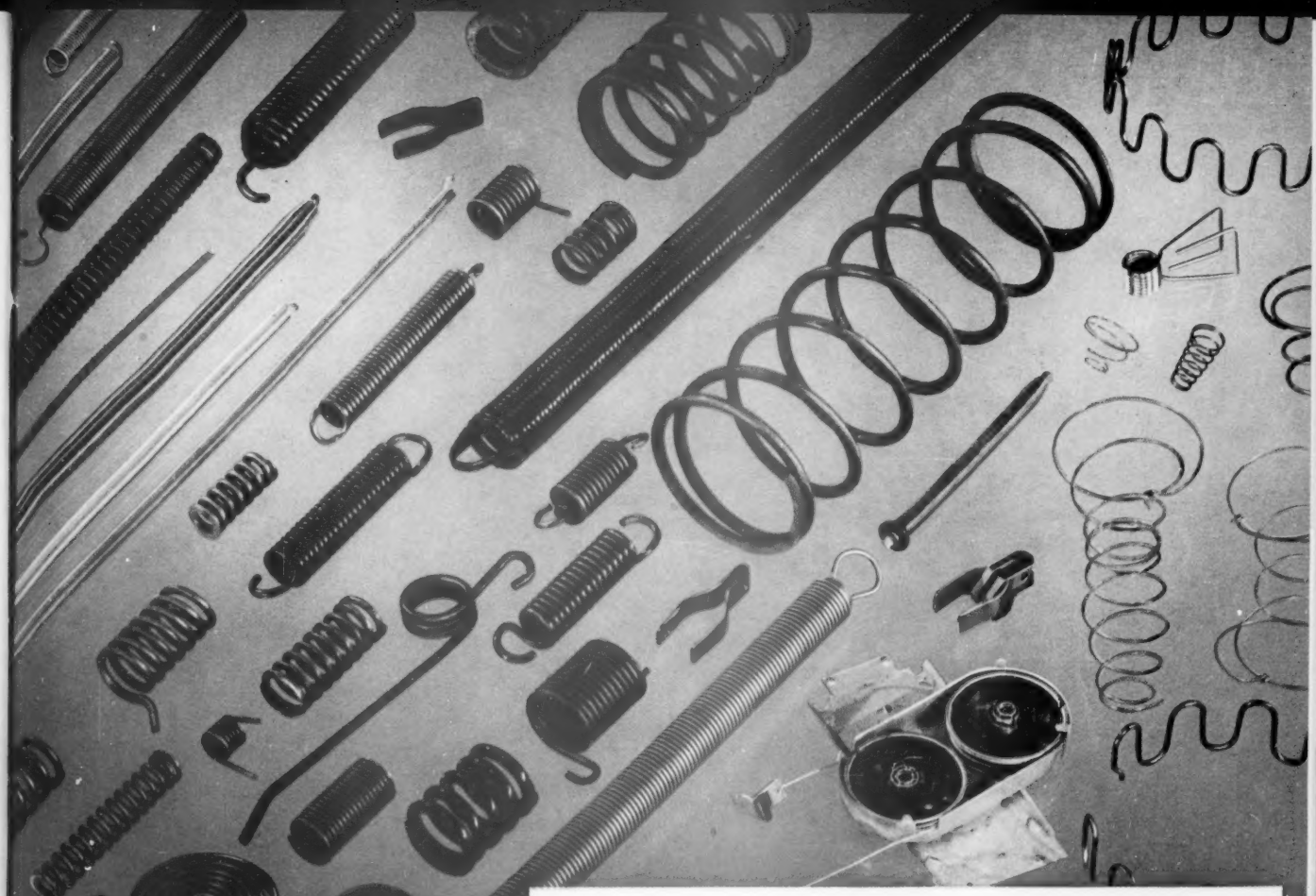
The regular Spring meeting of the Board of Directors will also be held during the meeting, the time for which will be announced to Board members by mail.

All wire men are cordially invited to be present at this fine Regional Meeting.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET • **STAMFORD, CONN.**



IF YOU MAKE *Springs*

YOU'LL DO BETTER WITH ROEBLING

ROEBLING makes high carbon steel spring wire and flat spring steel... and makes it *better*... for every sort of spring and for every product that requires spring characteristics. Hard drawn, hard rolled, annealed or soft, tempered or untempered ... they're all available to meet your requirements exactly.

Among these Roebling materials are zig-zag and no-sag wires; mechanical and valve spring wires; music wire; clock and motor type spring wires; flat spring steel and upholstery spring wire of all types. The variety of parts into which these are formed is almost endless, but manufacturers all report that Roebling quality and uniformity reduce machine downtime.

Learn for yourself how Roebling can help your production and product. John A. Roebling's Sons Corp., Trenton 2, N. J.

ROEBLING CF&I

Subsidiary of The Colorado Fuel and Iron Corporation

ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. & 5 PITTSBURGH ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 2340 GLENDALE-MILFORD RD., EVENDALE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • ROCHESTER, 1 FLINT ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • ST. LOUIS, 3001 DELMAR BLVD. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N.Y.

New

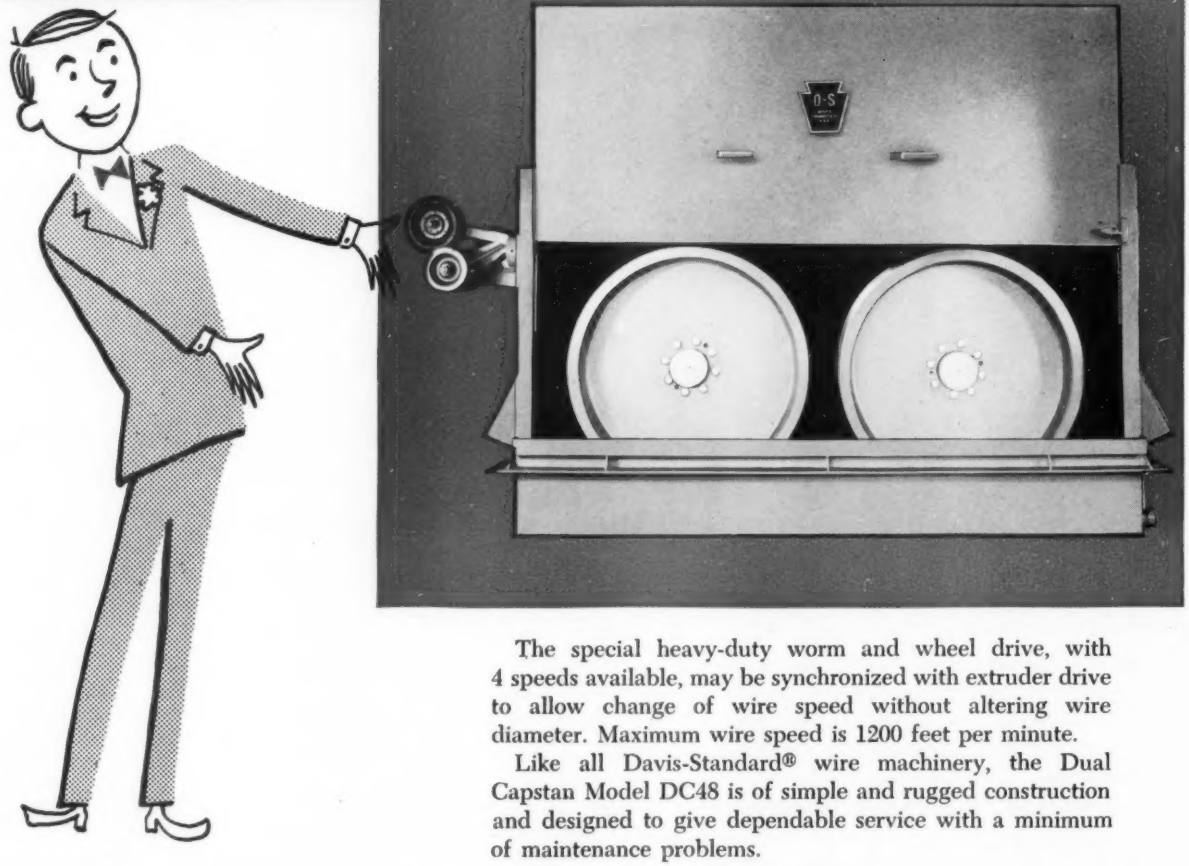
D-S
MYSTIC
CONNECTICUT
U. S. A.

CAPSTAN

Handles Cables With Up to 2¾" Diameter

The new Davis-Standard® Dual Capstan Model DC48 is designed to pull and provide additional cooling for insulated wire or cable after it has been extruded. This unit contains two 48-inch diameter drums that are capable of handling cable with a maximum diameter of 2¾ inches. Both drums are motor driven to prevent excessive wire tension when accelerating or decelerating. Wire scuffing is prevented by having both drums tilted.

Leak-proof water compartment and door are fabricated of heavy plate, and are properly sealed against corrosion. Adjustable air wipe efficiently removes water from wire after cooling.



The special heavy-duty worm and wheel drive, with 4 speeds available, may be synchronized with extruder drive to allow change of wire speed without altering wire diameter. Maximum wire speed is 1200 feet per minute.

Like all Davis-Standard® wire machinery, the Dual Capstan Model DC48 is of simple and rugged construction and designed to give dependable service with a minimum of maintenance problems.

For More Details write for Catalog Section 7.3

D-S
MYSTIC
CONNECTICUT
U.S.A.

DAVIS-STANDARD

Division of FRANKLIN RESEARCH CORPORATION

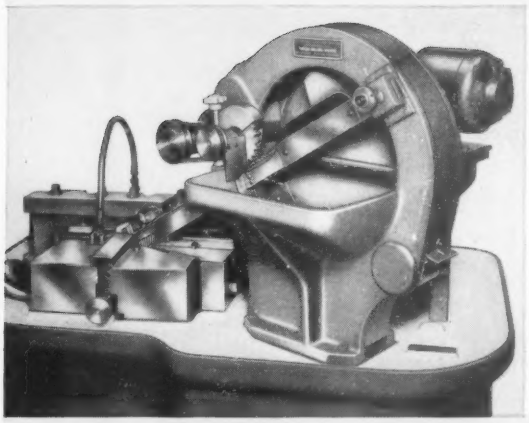
16 WATER STREET, MYSTIC, CONNECTICUT

IN EUROPE AND THE STERLING AREA, CONTACT FINNEY PRESSES LTD., BIRMINGHAM, ENGLAND

SCREWS or NAILS THREADED

with Hartford Special Automatic Thread Rollers

- **Diameters from .086 to .3125"**
- **Thread lengths from ⅛ to 2½"**
- **Large capacity hopper reduces refill time**
- **Positive positioning and feeding of blanks**
- **Variable bucket speeds**
- **Roll Class 3 Thread Fits**
- **Wired to J.I.C. Standards**



SPECIFICATIONS
MODEL A-190-R

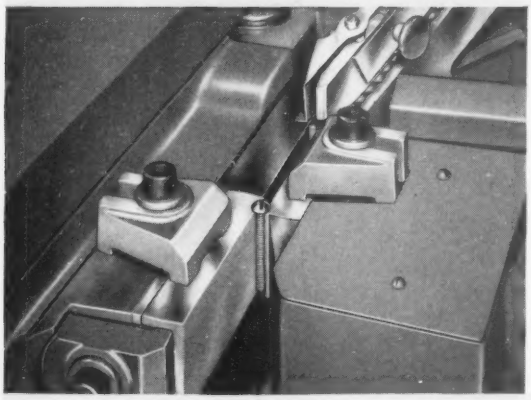
Screw Diameter Capacity: Machine Screw Sizes from #2 (.086) to #10 (.190)

Thread Length Capacity: ⅛" to 1½" with standard depth dies; 2" with special depth dies

Production Rate: 230 to 250 pieces per minute

Machine Dimensions: Length, 42"; Width, 26"; Height to table, 33"; Height overall, 52"

Floor Space Required: 4' x 5' approximately



SPECIFICATIONS
MODEL A-312-H

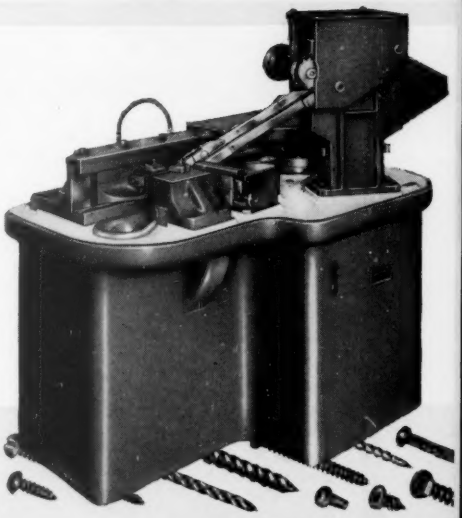
Screw Diameter Capacity: Machine Screw Size #6 (.138) to 5/16"

Thread Length Capacity: ⅛" to 2" with standard depth dies; 2½" with special depth dies

Production Rate: 80, 100, 120 or 140 pieces per minute dependent on screw size

Machine Dimensions: Length, 62"; Width, 39½"; Table Height, 36"; Overall Height, 63½"; Hopper Loading Height, 53"

Floor Space Required: 4'x6', approximately



Hartford's line of automatic Thread Rollers can accommodate all types of machine screws, sheet metal screws, drive screws, wood screws, nails and screwnails. They will also knurl, burnish or groove, and can handle specials as well.

These high production machines are equipped with a filtered lubrication system. They are vibration-free even at top speed. They are ruggedly designed, and engineered to provide "table-top" working level to reduce operator fatigue.

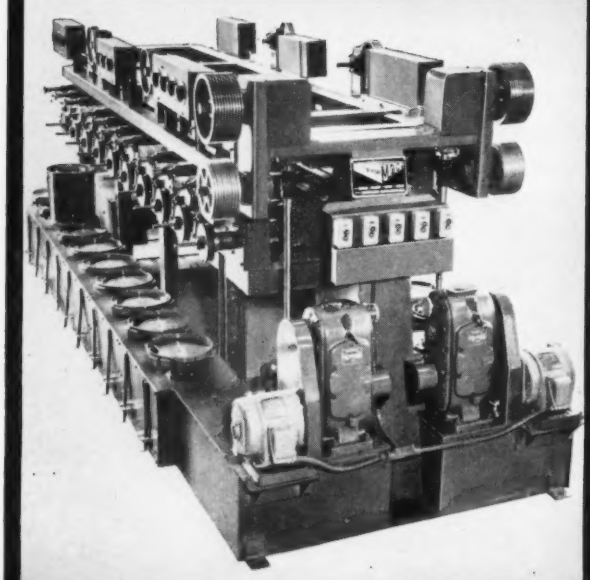
Write for Bulletin TR-102 for complete information.

Hartford Special also makes Drilling and Tapping Machines, Machine Components, Special Machines and the world famous Super-Spacer.

HARTFORD Special

MACHINE TOOL ACCESSORIES DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
2523 HOMESTEAD AVENUE HARTFORD 12, CONN.

NEW

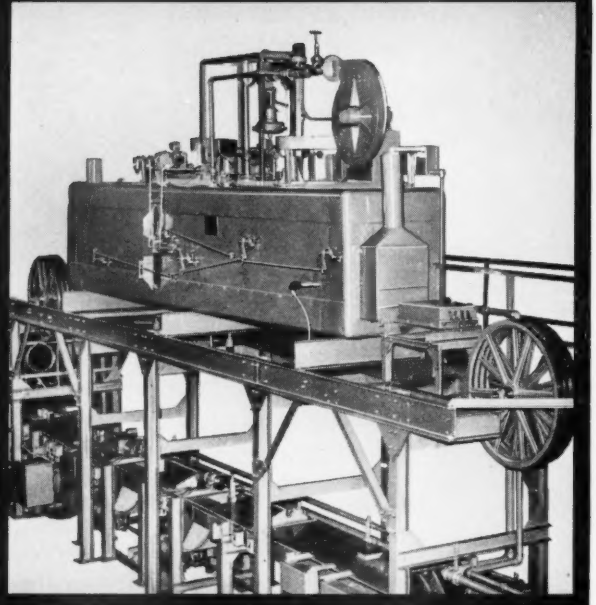


New Reel-R-Drum Packer handles two wire sizes simultaneously at different speeds through the same process.

MOCO's new Reel-R-Drum Packer is setting production records in forward-looking companies. This versatile unit has a speed range from 20 to 120 feet per minute. You can produce two wire sizes simultaneously through the same process at different speeds. Handling wire sizes ranging from .0089" to .025" in diameter, this MOCO Reel-R-Drum packages annealed copper magnet wire on different reels or in nominal 100 lb. capacity Payoffpak Drums, or both simultaneously. This versatile unit is built for tandem operation with a high speed MOCO type "C" wire enameling machine.

New MOCO Machine applies 2 servings of glass or yarn and 4 coats of baked insulating varnish

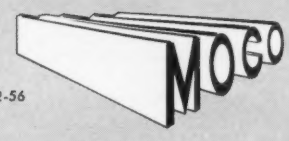
Satisfied users acclaim this new insulating, impregnating and varnish baking machine as a completely revolutionary development in the field of wire enameling. It is capable of turning out large quantities of heavy rounds and rectangulars (up to 150 M. Sq. Mls. Cross Sectional Area), baking on 4 coats of insulating varnish and applying two servings of glass or textile yarns . . . simultaneously! MOCO's revolutionary Rapid-Cool Oven lets you stop production without damage to wire in the oven. Return to full production in a matter of seconds because of the rapid rise of the temperature inside this MOCO Tunnel Oven.



FOR MORE INFORMATION

MICHIGAN OVEN COMPANY

425 BRAINARD • DETROIT 1, MICHIGAN



W2-56

Use nichols NEVER-STAIN®

Aluminum Wire

Made to your exact specifications, highest quality, excellent delivery

WRITE TODAY FOR INFORMATION HOW YOU CAN USE ALUMINUM WIRE IN THE MANUFACTURE OF YOUR PRODUCTS

NICHOLS WIRE & ALUMINUM CO.
Davenport, Iowa

One of the nation's leading producers of aluminum wire

HANDBOOK OF USEFUL FACTS FOR EVERY USER OF ALUMINUM ROD, BAR AND WIRE

Kaiser Aluminum Rod, Bar And Wire Handbook Makes Your Work Easier

Kaiser Aluminum offers you a complimentary copy of the *Rod, Bar And Wire Handbook,* an informative 160-page, hardbound book full of facts to help you in your work.

This handbook assists engineers, designers, production personnel and puchasing executives in the selection and use of the most suitable aluminum rod, bar and wire for many different applications.

And it contains information about the production of aluminum and its specific properties and characteristics as related to rod, bar and wire.

Covers A Wide Range Of Subjects

Here are a few examples of the type of information you will find in this valuable handbook.

ALLOYS — Data about various aluminum alloys and their application are presented. The differences between non-heat-treatable and heat-treatable alloys are explained. Tempers and temper designations are discussed. And quick summaries showing the various characteristics of 21 different aluminum alloys are offered for ready reference.

FORMING — Contains scores of useful facts. Cold heading and roll threading are described in easy-to-read text and graphic illustrations. And their advantages are listed. Valuable facts about wire drawing, covering such points as sequence of drawing operations and proper dies and lubricants to use in wire drawing, are contained in this section.

WELDING—Complete run-downs on such welding methods as gas, carbon arc, atomic hydrogen arc, inert gas-shielded arc and resistance welding are given. Soldering, brazing and mechanical joining information is included.

ENGINEERING DATA—The *Rod, Bar And Wire Handbook* contains 59 pages full of time and work-saving engineering data and tables: "Decimal Equivalents Of Wire And Sheet Metal Gauges," "Comparative Physical And Mechanical Properties Of Metals," "Conversion Of Thermometer Readings," "Chemical Resistance Guide," and many, many more. All tables are easy to follow, easy to work with.

DEFINITIONS — The handy glossary of descriptive words and definitions clarifies usage in conversation and in correspondence. This section defines such terms as "Brinell hardness," "compressive strength yield," "ultimate shearing strength" and over 50 others.

You're sure to find helpful, usable information in every section of this up-to-date handbook. Kaiser Aluminum's *Rod, Bar And Wire Handbook* is one of the most complete books of its kind. Look at all it offers you.

Complete Table Of Contents

- The Role Of Aluminum In Modern Industry
- Production Of Aluminum
- Qualities Of Aluminum
- Aluminum Rod, Bar And Wire Products
- Aluminum Rod, Bar And Wire Alloys
- Fabrication
- Forming Techniques
- Welding, Soldering, Brazing And Mechanical Joining
- Finishing
- Engineering Data And Tables
- Nomenclature And Definitions

Kaiser Aluminum & Chemical Corp.,
Industrial Services Division,
Room 8321, Kaiser Building,
Oakland 12, California

Please send me my copy of *Rod, Bar And Wire Handbook* immediately.

NAME_____

ADDRESS_____

CITY_____ STATE_____

MAIL THIS COUPON NOW

To get your free copy of Kaiser Aluminum's *Rod, Bar And Wire Handbook* simply mail coupon.

Kaiser Aluminum

See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.

FIBERGLAS FIRST!

VASTLY IMPROVED THERMOCOUPLE WIRE

developed by Claud S. Gordon Co.

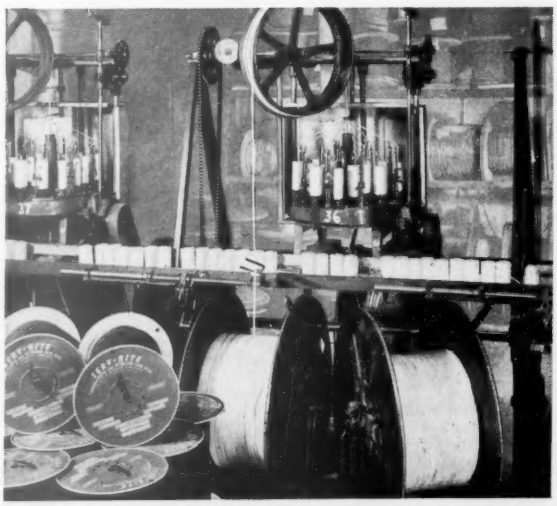
. . . made possible by new Fiberglas staple yarns!

Important news for wire and instrument manufacturers

Now bonded staple Fiberglas* yarns are available for use as outer braids on thermocouple lead and extension wires, and type AVA, AIA and AA applications. The Fiberglas covering permits a more durable, flexible wire. The Claud S. Gordon Company reports Fiberglas-braided thermocouple wire suitable for consistent use at temperatures up to 1000° F., with wide safety factor.

The Fiberglas braid covering contains no organic fibers, thus there is no powdering when the wire is subjected to high temperatures and adverse atmospheric conditions. The tough braid is easily stripped, yet has high tensile strength, superior coverage and good abrasion resistance. It is compatible with conventional finishes and can be color coded.

Learn more about all the excellent properties of this new bonded staple Fiberglas yarn for *your* wire-covering application. Write Dept. 211-C, Textile Products Division, Owens-Corning Fiberglas Corporation, New York 22, New York.



Bonded staple Fiberglas yarns on a Butt braider. These yarns can also be braided on high-speed equipment.

OWENS-CORNING
FIBERGLAS

*T. M. (Reg. U.S. Pat. Off.) O-C.F. Corp.

Place Your Order **NOW** *for*

THE NEW AND REVISED 1957 EDITION OF THE WIRE and WIRE PRODUCTS BUYERS' GUIDE AND YEAR BOOK of THE WIRE ASSOCIATION

The many new headings, new products, address changes and other important information changes in the listings of sources of bars, rods, wire, wire products, electric wire and cable and of sources for machinery, equipment and supplies used in the Wire Industry, make this directory

INDISPENSABLE!

The Year Book Section is also completely new. It contains information to keep you posted on the affairs of THE WIRE ASSOCIATION, such as:

OFFICERS AND DIRECTORS FOR 1957.

LIST OF ASSOCIATION MEMBERS.

LIST OF MEDAL AWARD WINNERS AND HONORABLE MENTION AWARDS.

CONSTITUTION AND REVISED BY-LAWS.

HISTORY OF ASSOCIATION ACTIVITIES, DURING 1956.

INDEX TO ARTICLES AND SUBJECTS IN WIRE AND WIRE PRODUCTS FOR 1956.

INDEX OF AUTHORS FOR YEAR OF 1956.

The Price: $5.00 Per Copy

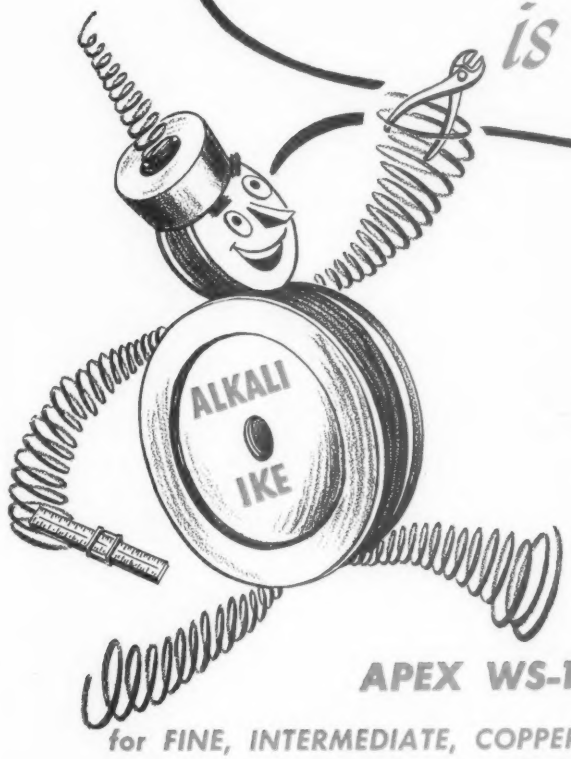
Subscribers to WIRE AND WIRE PRODUCTS receive a discount of 40%. Association members receive a copy without additional cost, but may order extra copies at $3.00 each.

Keep yourself up-to-date. Send your order today to

WIRE AND WIRE PRODUCTS

453 MAIN STREET ● STAMFORD, CONN.

The only difference between a rut and a grave is the dimensions!



WE REALIZE THAT in order to stay in business, we cannot allow ourselves to get into a rut. With our responsibility both to you and to ourselves in mind, we'd like to tell you about an entirely different type of Wire Drawing Lubricant.

HERE'S A NEW FORM OF WET WIRE DRAWING LUBRICANT . . .

APEX WS-104 Special

for FINE, INTERMEDIATE, COPPER-COATED, STEEL, LIQUOR-FINISH AND GALVANIZED WIRE.

It's advantages are:

- ease of mixing
- non-foaming
- stable emulsion
- complete absence of copper soap formation
- brighter, cleaner wire
- cleaner machines
- freedom from rancidity
- minimum sludge formation
- less build-up on filtering or screening systems

For actual plant experience data . . .
simply drop us a line on the coupon indicated

APEX ALKALI PRODUCTS COMPANY

Lubricants & Cleaning Compounds for Wire & All Wire Products

Main and Rector Streets · Philadelphia 27, Pa. · IV 3-3939

Yes . . . I'd like to know more about your different type of WET WIRE DRAWING LUBRICANT . . .

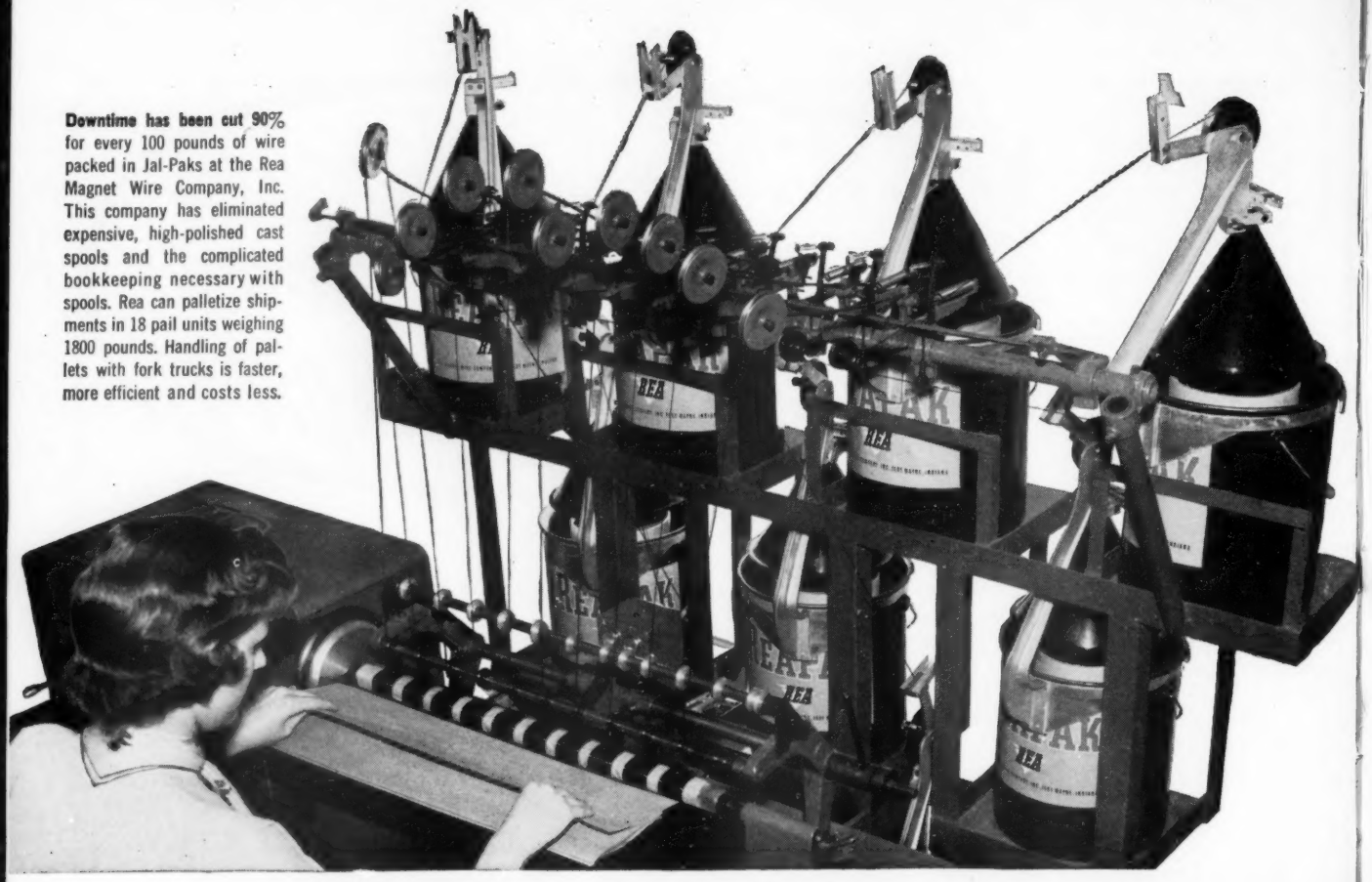
APEX WS-104 SPECIAL

Name.....

Firm.....

Address.....

Downtime has been cut 90% for every 100 pounds of wire packed in Jal-Paks at the Rea Magnet Wire Company, Inc. This company has eliminated expensive, high-polished cast spools and the complicated bookkeeping necessary with spools. Rea can palletize shipments in 18 pail units weighing 1800 pounds. Handling of pallets with fork trucks is faster, more efficient and costs less.



Jal-Pak STEEL WIRE PAILS

improve wire packaging 3 ways...

FASTER PACKAGING results due to advanced design of Jal-Pak. Downtime is reduced as much as 90%. No rethreading, replacing or rejoining is necessary. Rigid cylindrical cores of steel or fiber lower your investment. No deposit or return is required.

BETTER PRODUCT IDENTIFICATION with Jal-Pak pails increases consumer acceptance. Bright colorful pails stand out in storage racks. Product name is readable at a distance.

COMPLETE PROTECTION is assured by this steel pail with exclusive rolled, smooth, side seams and smooth surfaces with no obstructions to cause snarling or kinking. Tight closures eliminate deterioration in storage.

Jal-Pak wire pails are now available for brass, copper, steel, aluminum, stainless steel, alloys, welding and soldering wires.

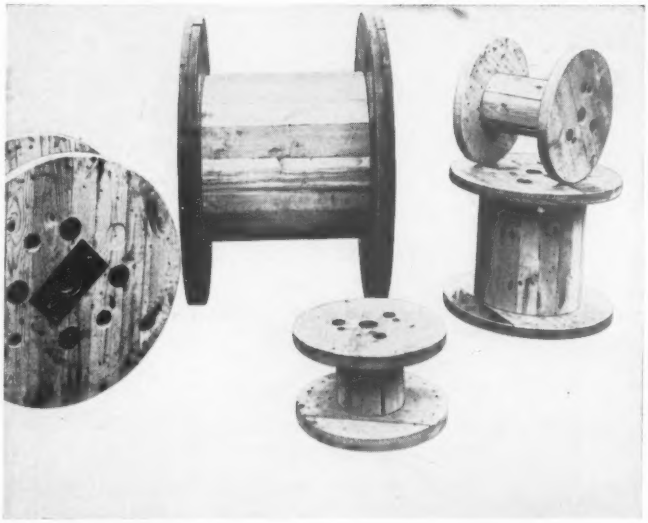
For facts on how Jal-Pak can increase production and sell more wire for you, call your nearby J&L representative, or write direct to the Container Division.

J&L STEEL

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH
Container Division
405 Lexington Avenue, New York 17, N.Y.

SAVE with..
NON-RETURNABLE
WOOD shipping REELS...

for all sizes and types of Electric Wire and Cable



Look at these advantages:

- *Reduced Reel Investment*
- *Less Storage Space*
- *Lower Freight Costs*
- *No Repair Costs*
- *No Return Freight Costs*
- *No Bookkeeping*
- *No Cash Deposits Req'd.*
- *No More Headaches ! !*

NON-RETURNABLE REELS ALLOW DEFINITE PACKAGING COSTS.

HIGH SPEED

SHIPPING SERVICE in our... OWN TRUCKS

within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

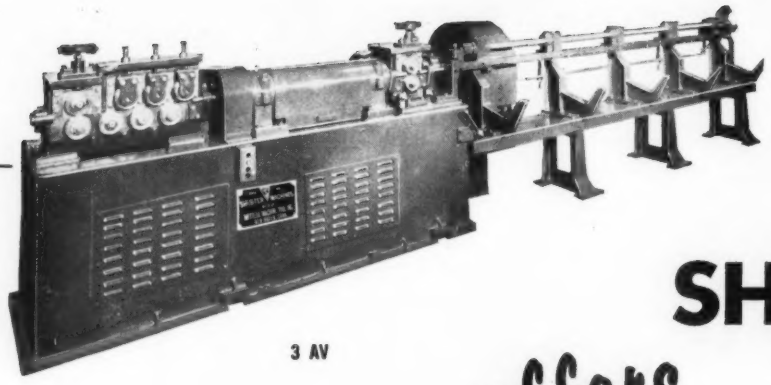
BRIDGE
MANUFACTURING COMPANY
HAZARDVILLE, CONNECTICUT

Telephone . . .
Thompsonville, Connecticut
RIverview 9-8308

"REEL GOOD . . .

Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.

WOOD REELS"



3 AV

90th year

SHUSTER offers most!!

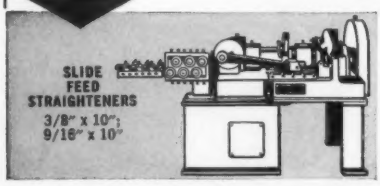
In Wire Straightening and Cutting, SHUSTER variable speed machines consistently provide the newest tested principles of operation – SHUSTER'S 90 years' know-how will cut your wire straightening and cutting costs every day!

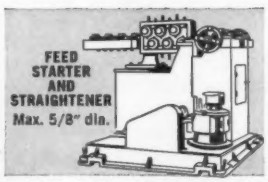
	SHUSTER	Manufacturer B	Manufacturer C	Manufacturer D
Infinite variable speed of all feed and cutoff ranges	YES	NO	NO	NO
Electrically controlled Target and Clutch	YES	Some Models	NO	NO
Power Consumption	LOW	HIGH	MEDIUM	HIGH
Complete On-The-Job Engineering service	YES	NO	NO	NO
Flat and Shape Stock Machines available	YES	YES	NO	NO

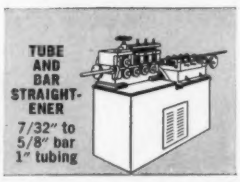
SHUSTER – the *first* name (since 1866) in Wire Straightening and Cutting, offers *more* production features, at less investment and operating cost, than have ever been available in the field!

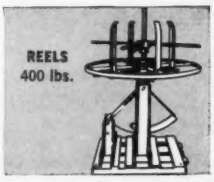
METTLER
MACHINE TOOL, INC.
155 West Adeline Street, New Haven, Conn.

This too is SHUSTER.









THE BEELINE WIRE DRAWING MACHINE

Straight-line type Wire Drawing Machine for high production of all wire grades

This picture shows a Beeline DG 4, built for an inlet wire diameter of about 7 mm (approx. .276 inch). High carbon steel.

Prominent Beeline features:

- Complete absence of slipping between wire and block.
- Direct block-to-block wire running, with automatic speed control and no loops or other mechanical adjusting devices.
- Continuous speed adjustment from almost zero up to maximum.

Let us help you solve your problems. We shall be glad to answer your questions promptly. Don't forget to let us know what wire is to be drawn, the inlet and finished diameter, its intended use, the production required, and all other relevant information (tensile strength of the finished wire etc.). Then we can suggest a machine that is just right for you.

The machine is at present manufactured in three different sizes:

BEELINE DG 5
for heavy wire, about 13 mm. (.500 inch)

BEELINE DG 4
for wire rods, about 7 mm. (.276 inch)

BEELINE DM 3
for wire with an inlet diawire of about 3 mm. (.116 inch)

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK VERKSTADS AB • MORGÅRDSHAMMAR • SWEDEN

Cables: Morgårdshammar, Ludvika. Tele: 0240–71100

For the FINEST Dies...

Specify

There Are Many Reasons Why V-R Leads The Field!

V-R NEW Cylindrical nib and improved method of assembly insure high degree of concentricity.

V-R . . . First in producing the only Tantalum-Tungsten carbide developed specifically for Drawing Dies.

V-R . . . First to manufacture Carbide Dies with preformed rough cored back relief.

V-R . . . First to furnish Carbide Dies rough cored to finish at hole sizes below .010".

WRITE TODAY for NEW Vascoloy-Ramet Die Catalog VR-461.

The New V-R Die Catalog gives complete ordering information on all V-R Dies for drawing wire, rod, bar and tube.

Vascoloy-Ramet CORPORATION

882 MARKET STREET
WAUKEGAN, ILLINOIS

The Wire Outlook

Much of the talk about the dire effects of inflation is concerned with long range trends and not the immediate threat of a severe deflation. The concern, however, emphasizes the need for trimming government budgets to bring expenditures under income and making significant tax reductions. A government's fiscal status nowise differs from an individual's—if outgo exceeds income, the result is bankruptcy.

It is good to note that automotive production is running ahead of 1956 by about 5% and cars are selling. The steel industry is holding up, electrical output is setting new records and new orders are piling up to keep manufacturers busy. The tight money policy is being questioned in many quarters, but further inflation for the moment appears to have been checked.

Last month we commented on the anomaly of the operation of the wire industry at levels lower than that of the general average of business. The probable explanation lies in the increasing quantities of rods, wire and merchant wire products that are being imported. Most of these products are being offered here at prices well under those that domestic producers can justify. For example, 40% of the 1956 barbed wire sales came from imports.

This is a direct effect, often referred to in this column, of labor's annual demands for ever higher wages, of our high tax structure and of the government's policy of lowering import duties. Unless corrective measures are taken, these factors will tend further to aggravate the condition of domestic wire manufacturers. We must awaken to the fact that the producers we have been building up through our foreign aid program are underselling us because of their lower wage and living standards.

There can be no criticism of foreign goods as such. Competition that comes to us on an equal footing is healthy. Nor is there any question of our attitude toward our foreign friends—we welcome them and their products where prices, quality and production conditions are comparable. Free, unrestricted trade, such as the Administration seeks to achieve, is a Utopian ideal for which the world is not ready.

Is not an answer to our own problem the establishment of sliding scale tariffs on imports that equalize the wage differentials between this and other countries? Where a foreign producer is able to pay its labor only a fraction of the wages we pay at home, the goods, if made with equal efficiency, can be offered at prices below ours. In our book, this kind of competition is not right.

We submit that it works to the detriment of domestic producers to allow entry of products made under lower standards of living to compete with concerns and people who have been bearing excessive tax burdens to finance industry abroad. These overly heavy taxes, in themselves, add considerably to our own costs. When superimposed upon labor's wage policies, it creates an intolerable situation. Actually, we are out of step with the rest of the world, the primary answer to which, if we are to maintain a solvent economy, is a schedule of equalizing tariffs.

Copper prices have fallen again, the uncertainty regarding them leading to hand-to-mouth buying on the part of both electric wire manufacturers and their customers. There is evidence that copper will soon be in such abundant supply that further cuts are likely.

Aluminum has been so plentiful that a number of reduction units have been shut down, but it is expected that as the year progresses the demand will build up enough to re-open them.

Merchant wire products have started to pick up seasonally. Manufacturers' wire is on a longer delivery, but readily available. Sales are down 25% from a year ago, however. Spring sales are on a hand-to-mouth basis and heading wire sales are spotty.

Things could be worse, although they should be a lot better. Probably what the wire industry needs is a Washington lobby to protect its interests.

Edmund Duval Sickels
EDITOR

STEELSKIN

IF *you need a drawing lubricant or a coating compound...*

Whether you need a *powder,* or a *grease* . . . whether it's to be used for *wet* or *dry* drawing . . . you want a *dependable* product.

That's why it's just good business to buy a **STEELSKIN** product. You see, we have just *one* business. We're *specialists* in making wire drawing lubricants. We've learned how — in our many years of specialization — to insure the exceptional performance, the fine, consistent quality of the **STEELSKIN** lubricants we manufacture for you.

What's more, our men in the field . . . the men who call on you, are *specialists* too. They're equipped to help you on any wire drawing problem.

So, when you buy metal working lubricants . . . *why not buy dependability?*

Buy STEELSKIN!

Steelskin
REG. U.S. TRADE MARK

R. H. MILLER
COMPANY, INC., Homer, N. Y.

METAL WORKING LUBRICANTS

WIRE
AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 32 March, 1957 No. 3

Electropolishing Stainless Steels —A Useful Finishing Process

By William E. McFee
Supervisor, Product Information Service
Armco Steel Corporation
Middletown, Ohio

The Armco electropolishing process is a brightening method that imparts a high luster to stainless steel wire and wire products. It is best described as the reverse of electroplating. In electropolishing the work is the anode and metal is removed. In plating the work is the cathode and metal is deposited.

★ ★ ★

Metal loss is very low, only about 0.0002 to 0.001 inch. This depends on the surface being treated, the treatment time and current density. Brightness and uniformity of finish also are largely dependent on the condition of the surface before electropolishing. Smooth, dense surfaces free from scratches and tool marks are best. Treatment time is shorter, less metal is removed, and a finer finish is obtained.

★ ★ ★

All types of stainless steel can be electropolished; yet the process is best suited to the chromium-nickel grades. Type 302 is an example. The process does not require a highly trained operator under supervision, once the simple principles are understood.

Questions are frequently received regarding electroplating of stainless steel and to answer them more completely, the author kindly consented to prepare an article on the subject

He will be glad to furnish further information on solution analyses, operational requirements, electrolyte compositions and characteristics of the two methods described. He may be addressed direct or in care of this paper.

It is interesting to note that a patent (U.S. 2,752,305) was recently granted for the electrolytic polishing of aluminum or aluminum-rich alloys. Parts are immersed in an electrolyte comprised of 45-80% phosphoric acid, 5-20% sulfuric acid (the total acid being no more than 90%), 1-5% glycerophosphate and the remainder water; the article is etched and then subjected to a direct current with the article as the anode.

Equipment is Simple: All you need is a source of low voltage—6 to 12 v.—direct current; a tank to contain the electrolyte; holding racks; cathodes to meet your requirements; and rinse tanks. An ammeter and rheostat are included in the circuit for current control. Also a thermometer is needed to measure electrolyte temperature. This is very important because the finish is affected by temperature.

★ ★ ★

What to Do: Connect the article to be polished (anode) to the positive current lead with suitable clamps or holders; then immerse it in the electrolyte with all parts of the anode from ½ to 1½ inches or farther from a cathode element. Attach the negative current lead to the cathode system in the bath. Proper location of the two is important to uniformity of finish.

★ ★ ★

Treatment Time: This depends on the original finish, current density, bath temperature and shape of the part. Usually a bright finish is achieved in 2 to 10 minutes, but again the starting surface and use of the recommended range of current densities have a bearing on this.

★ ★ ★

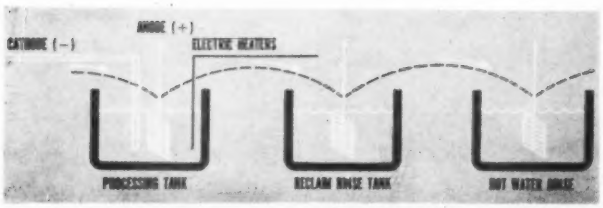
When the surface is rough, lightly scaled or heavily discolored, lengthen the treatment to obtain the desired luster.

★ ★ ★

You can't harm the surface by prolonged electropolishing. Metal loss is about 0.001 inch in a ten-minute period. This can be stepped up by increasing the current density.

★ ★ ★

Pretreating the Work: If it is

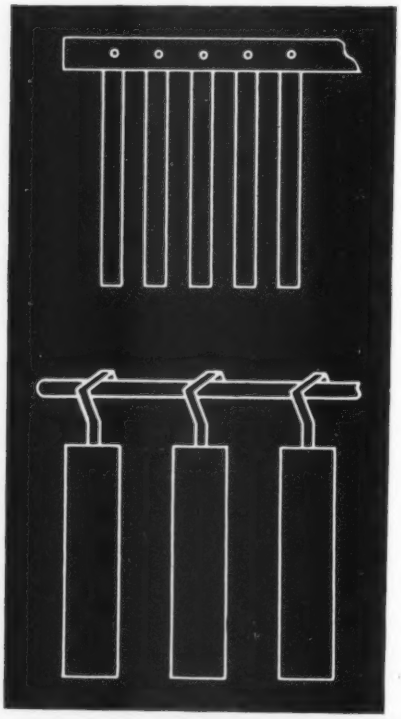


Drawing 1: Sequence of operations-Cathode-Anode-Processing Tank-Electric Heaters-Reclaim Rinse Tank-Hot Water Rinse. * * * *

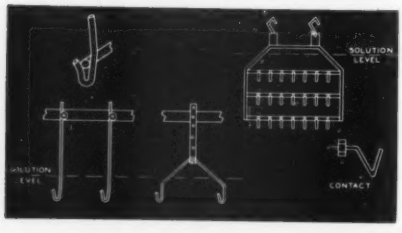
reasonably clean no pretreatment is required. However, the cleaner the part the longer will be the useful life of the electrolyte. Remove lubricating finishes—such as lime, copper, lead or cadmium coatings—with a dilute solution (15 to 20% by weight) of nitric acid at 120 F to 140 F.

★ ★ ★

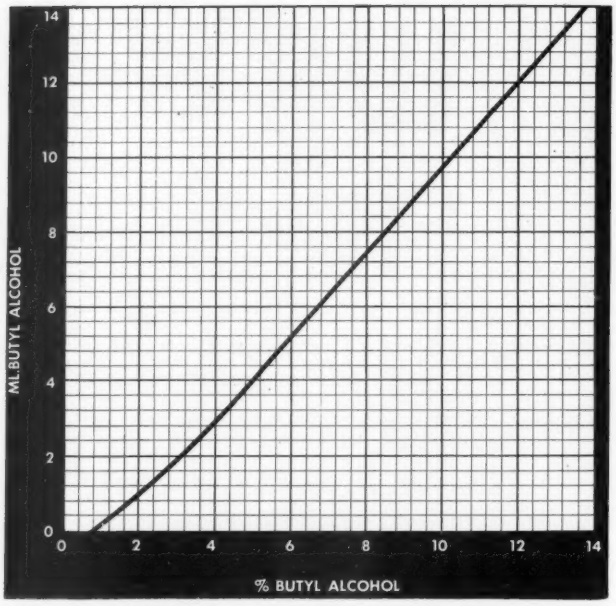
Oil and grease can be removed with an alkaline cleaner or degreasing unit.



Drawing 2: Two conventional methods of hanging cathode strips. Arrangement shown in lower drawing is designed for added flexibility. * *



Drawing 3: At left are racks with pinch-type "V" hooks used for parts made of wire or rod. The 3-row rack at right is for batch electropolishing of small parts. * * * *



Drawing 4: CONVERSION CHART—For determination of per cent butyl alcohol in phosphoric acid-butyl alcohol solution. (Method 2). * *

★ ★ ★

Condition of the Metal: Sometimes fabricating processes change the metallurgical condition of stainless steel wire products in such a way that the metal will not respond well to electropolishing. Important among these are:

(1) **Exceptionally severe cold-working**
(2) **Such special treatment as nitriding**
(3) **Improper heat treatment of the material**

Source of Current: A 6-12 volt rectifier or d-c generator capable of supplying ½ to 2 amperes per square inch of surface area usually is adequate.

★ ★ ★

Current Needs: This depends on the area and shape to be polished, and is also affected by the size and shape of the unit.

★ ★ ★

Heating the Bath: Normally the electrolyte is internally heated through electrical immersion, heaters or steam coils. Either one must be acid resistant. Do not apply heat at the tank bottom.

★ ★ ★

Number and size of the heating elements are governed by the volume of solution, radiation, and exposed surfaces. A 2,000 watt heater or equivalent will raise 100 gallons of solution to operating temperature.

★ ★ ★

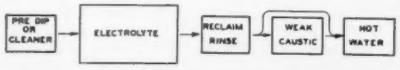
Thermostatically controlled heaters are much preferred to manual operation because they hold the temperature within the proper operating range.

★ ★ ★

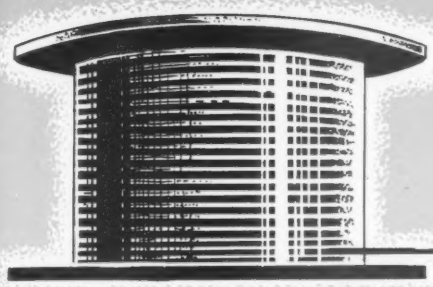
Heat generated by the electric current helps maintain the bath at operating temperature. Too much current for a given quantity of solution causes overheating, causing a frosty nonuniform finish which generally is undesirable. About 400 amperes is the highest current that can be used in a 100 gallon tank under normal conditions.

★ ★ ★

Where more current is necessary the excess heat must be dissipated to keep the solution within the most effective operating temperature range. An excellent way to do this is to introduce cooling water through the steam coils by use of a 2-way valve, or by the use of water jackets around the tank. In some cases relocation of the cathodes will do it.



Drawing 5: Sequence of operations for electropolishing by Method 1. * * * *



Vol. II No. 1

News of Interest to the Wire and Cable Industry

MONSANTO

PUBLISHED BY MONSANTO CHEMICAL CO., PLASTICS DIVISION, SPRINGFIELD, MASS.

WIRE Recorder

REG. U.S. PAT. OFF. MONSANTO CHEMICAL CO.

New Street Lighting Lures Shoppers Downtown

Downtown merchants are striking back at suburban shopping centers with a "new weapon": street lighting. Throughout the nation, many cities, small and large, are lighting up in a big way in an effort to stem the flow of shoppers to suburban shopping centers.

Here's a look at a couple of bright spots (or soon to be) across the nation where a substantial investment in downtown lighting is expected to result in sales boosts for the merchants who are picking up a good share of the lighting tab.

In Cleveland, Ohio, 128 new fluorescent street lights line both sides of Euclid Avenue, giving the entire section at night a clean, modern look it lacked before. Merchants expect their new "Luminous Lane" to stimulate sales in the downtown area. And in the Windy City, merchants on State Street are hoping to regain a title: "The most brilliantly lighted street in the world". Back in '26, Chicago merchants invested $100,000 in new street lighting, which was three times the intensity of the world's most brilliantly lighted street up to that time. Not only did the increased lighting intensity create public interest, because it was such a noteworthy advance, but it proved to be a good investment for the merchants. It took the rest of the world nearly 25 years to install a better system.

Currently ,Chicago merchants are considering an investment of between $300,000 and $400,000 to install a new system. Here's what the system will do for Chicago's State Street: provide a light intensity of nearly three times the present intensity at approximately the same cost for electricity; provide a considerably improved source of light with much better seeability; improve the color of the light; greatly improve the distribution of light due to the longer light source and higher poles which are to be used; considerably reduce the purchase cost of light bulbs and reduce labor costs required to change burned-out bulbs; and greatly improve the appearance of State Street—daytime and nighttime—giving the famous Chicago Street the distinction of having the world's most brilliantly lighted street.

The proposed relighting of State Street is only a part of Chicago's overall lighting modernization program. The 10-year program just completed has resulted in the installation of 70,000 new street lights throughout the City. Mercury-vapor lights line 400 miles of arterial streets and incandescent lights line 1,800 miles of residential streets. Chicago spent $58 million on the program and city officials estimate it will take another $52 million to put new lights on 1,200 more miles of streets.

Other cities throughout the nation are lighting up, too! In Olympia, Washington, they have just finished a

(Continued on Page 4)

Residential Rewiring Gets New Emphasis

"Forty-two percent of the nation's homeowners spent almost nothing on improvement projects last year even though 70% of American housing units are in need of some attention and repair." At a recent conference of the National Association of Housing and Redevelopment officials, James C. Worthy, Vice-President of Sears-Roebuck and Company, stated further that present expenditures of only $8 million should be tripled to $24 million a year to keep the nation's housing up to a "reasonable standard."

Another speaker at the conference, Clayton Fisher, General Electric Consultant, estimated that if only 10% of the urban redevelopment goals of the American Council to Improve our Neighborhoods (ACTION) were to be carried out in the next ten years, it would mean a sales increase of $2

(Continued on Page 3)

MONSANTO

Wire Recorder
newsletter

While great things were expected from the recent laying of the new transatlantic cable, even the most optimistic were not quite prepared for what has actually happened: A report from one city shows a boost in overseas calls of 33-1/3%. Transatlantic telephone calls originating from Springfield, Massachusetts, home of Monsanto's Plastic Division, increased from 300 to 400 calls a month in the first thirty days the new $42 million cable has been in operation. The increase is attributed to greater availability of lines, speedier service and improved voice clarity over radio-telephone.

A $2 billion hike in electrical goods is forecast for 1957. The National Electrical Manufacturers Association predicts the industry will establish a new record this year when it will turn out $21.5 billion worth of electrical products. According to Joseph F. Miller and A. J. Nestie, managing director and chief statistician respectively of NEMA, all phases of the industry will show substantial growth, with sales ranging from 5% to 15% over the 1956 total. Mr. Miller further predicts that with the use of electric energy for all purposes moving sharply up, the demand and need for electrical generation, transmission and utilization equipment will continue to grow, presenting an optimistic long-term picture for electrical manufacturers. Industry volume in the near future, according to Mr. Miller, can be expected to reach what might be regarded today as fantastic amounts.

"Electronic shorthand"...a method of speeding your voice from telephone to telephone with less equipment is currently being explored at the Bell Telephone System labs. This is a method by which samples are snipped from a speech sound - just enough to identify it - and sent by telephone to a receiver that rebuilds the original sound. According to Bell, "modern shorthand" could mean not only improved service, but a more economical use of existing lines; i.e., voices could be sent by fewer electric signals, and more voices could be sent over each wire.

The largest closed-circuit telvision system anywhere is expected to cut ticket buying time at Penn Station by 90%. The new streamline ticket sales and reservation system is a maze of closed-circuit television, wire-photo, and teleprinter gadgets valued at $2 million. A total of 105 TV cameras and 101 receivers is expected to save much time, trouble, and vexation for travellers buying tickets on the Pennsylvania and connecting railroads. The new Pennsy installation represents the first use of closed-circuit TV by the transportation industry to speed reservation and ticket sales.

Many firms are anxiously awaiting completion of a new census study -- an inventory of housing. The survey, due to be completed about midyear, will reveal the number of housing units in the U.S., their type, condition, and trends in heating methods. The results will give construction firms, real estate dealers, city planners, economic analysts, and others, excellent tools for measuring the nation's housing needs. This basic information will also shed light on market prospects for such things as household goods, consumer products, and service industries.

(Continued from Page 1)

billion for electric appliance manufacturers.

It is quite obvious that current promotional programs to educate consumers along these lines, urging American homeowners and landlords to increase spending on home improvements, are an absolute necessity. Throughout 1957 utility companies in particular will put more emphasis on projects like "Live Better Electrically", "Operation Home Improvement", and "Housepower" with the full realization that most home improvements and further purchases of modern electric appliances depend on adequate wiring which, in most cases, means a hard-hitting residential rewiring program if the desired goals are to be attained.

More Approvals For Opalon 1038

Monsanto's Opalon 1038 has received two new U-L approvals: approval for 90°C, 1,000 volt use in wall thicknesses 1/32″ and greater, and 90°C, 600 volt use in wall thicknesses 1/32″ and greater. These new approvals, along with those already received, qualify this versatile material for a number of new applications.

Approval for 90°C, 1,000 volt use, coupled with the T, TW, 60°C oil exposure and 80°C approval which Opalon 1038 has already received, make this material ideal for the *machine tool industry*. Of special interest to *radio hook-up and appliance wire manufacturers* who have approval only for 90°C, 600 volt material is the approval for 90°C, 1000 volt use in wall thicknesses 1/32″ and greater.

Currently Opalon 1038 is widely used for U-L Type T, TW and exposure to oil at 60°C, as well as for U-L 80°C appliance wire. Its rugged physical properties, including weather and flame resistance, also qualify this material for insulating large-sized building wire (#6 AWG and over) and for cable jacketing. This same compound is recommended for both primary insulation and jacket in UF-NMC, underground feeder and non-metallic sheathed cable. To date Opalon 1038 is the only material which has attained this combination of approvals.

The high insulating efficiency, excellent heat resistance and extreme toughness of Opalon 1038 provides outstanding performance on a wider range of wire and cable applications than ever practical before.

New Polyethylene Jacketing Extends Service Life of Telephone Cable

The service life of telephone cable is largely dependent upon the protection afforded by polyethylene jacketing compounds. Two properties which insure adequate protection for expensive telephone systems are resistance to environmental stress cracking and resistance to outdoor weathering.

Accelerated tests for determining stress crack resistance of polyethylene compounds have been developed (primarily by Bell Laboratories), to predict whether a jacketing material can withstand the rigors of telephone cable service environments. Monsanto's new high molecular weight polyethylene jacketing compound, 14202, exhibited outstanding resistance to environmental stress cracking in all such laboratory tests run to date. Tests utilizing both single-fold and double-fold specimens have borne out this superior resistance of 14202.

Resistance to ultraviolet weathering is obtained by thoroughly dispersing a sufficient amount of fine particle size carbon black in the polyethylene compound. Thorough dispersion and the use of fine particle size carbon black are necessary to assure complete protection from ultraviolet rays. To insure optimum service life for telephone constructions 14202 contains a concentration in the range of 2.5 to 3% of carbon black having a particle size of approximately 17 millimicrons. Microscopic examination by transmitted light of thin films prepared from 14202 reveal the excellent degree of dispersion attained in Monsanto's manufacturing process. As a further indication of the weather-resistant properties of this compound, absorbtivities in the range of 50,000 have been obtained in light transmission measurements.

Other properties of the new compound are the excellent strength characteristics obtained with high molecular weight polyethylene, and good creep properties. Of further importance is the fact that 14202 is deformed under load at 100°C only about half as much as are normal molecular weight polyethylene wire compounds (melt index 1-2).

Experience to date has indicated 14202 produces smooth extrusions at competitive speeds. An additional benefit to manufacturers operating at high rates has been the low power requirement of this compound.

To minimize start-up problems after enforced shut-downs, and to protect the physical properties of 14202 during exposure to heat an extremely efficient antioxidant has been included in the compound. As a result, it has proved possible to resume jacketing operations with a minimum of bleeding after stoppages as long as one hour with 14202, having been exposed to normal operating temperatures during the entire stoppage interval.

The excellent performance characteristics of 14202 qualify it for all telephone cable jacketing applications, including REA PE-14 types. Some typical properties of 14202 are given in the table below.

	PROPERTY	*TEST METHOD*	*TYPICAL VALUES*
Basic	Specific gravity	ASTM D-792-50	0.93
	Carbon black content	———	2.5-3%
	Melt index	ASTM D-1238-52T	0.3 dg./min.
Thermal	Memory	———	35%
	Brittleness temperature	ASTM D-746-54T	⟨−75°C
	Tensile strength		
	Yield	ASTM D-412-51T	1325 psi
	Ultimate	ASTM D-412-51T	2400 psi
Mechanical	Elongation		
	Yield	ASTM D-412-51T	110%
	Ultimate	ASTM D-412-51T	650%
	Dielectric constant		
	@ 1 mc.	ASTM D-150-54T	2.6*
	@ 60 mc.	ASTM D-150-54T	2.6*
Electrical	Dissipation factor		
	@ 1 mc.	ASTM D-150-54T	0.003*
	@ 60 mc.	ASTM D-150-54T	0.008*

**After 3 hours mill rolling at 160°C*

SPEAKING OF EXTRUSION

(Condensed from an article by R. D. Sackett, Monsanto Technical Service Associate, which appeared in the SPE Journal)

Increasing use of thermoplastics for wire coating and pipe, coupled with the expanding use of rigid and flexible sheeting, all have stimulated new interest in extrusion. The fact that extrusion is a virtually automatic process has given additional impetus to its growth.

But the technology of extrusion has not always kept pace. There are still many gaps to be filled and there are still many concepts to be brought into proper perspective. One such concept is a wholly satisfactory method of classifying extruder screws.

Compression ratio (CR) has been considered a convenient means of classifying screws. Because appreciable differences have been observed between screws of different CR's, this method of classification has been regarded as adequate by many. However, in varying the CR, dimensions have been altered which may be even more critical than the CR itself. The importance assigned to CR is, in many cases, exaggerated and permitted to overshadow other factors of screw design which are more important to quality and output.

In a great number of cases flight depth, pitch and length of the metering section are all considerably more important. Yet they are not as thoroughly considered as changes in CR.

If we were to compute the capacity of the feed section of most screws by theoretical methods, we would find that the feed section is overdesigned and in some cases, capable of forwarding as much as ten times the actual output of the extruder. With this large excess capacity, it is evident that the primary function of CR is not merely to densify the material (although this is of secondary importance). The main function of CR is in preventing air from being occluded and carried forward. CR is also of importance in forming a wedge of material against the barrel wall to improve heat transfer. This wedge will also result in increased frictional forces against the barrel wall, aiding both in the mechanical development of heat and in the conveying action of the extruder.

There are essentially two common means of obtaining CR: decreasing pitch, and increasing the root diameter. In some cases combinations of both are used.

A British publication recently described tests comparing two screws of the same CR but obtained by different methods. The two screws had comparative compression ratios from beginning to end. The material used was polyethylene.

The author's conclusion was that it was not so much the actual ratio but how the ratio was obtained that was important. He reported higher and steadier rates from the screw with a constant pitch and a decreasing flight depth from the screw with a variable pitch.

The general trend today is towards the use of constant pitch screws. The feed section is designed for high output, with the flight made about as deep as torque requirements will permit. This means that to increase CR, it is usually necessary to decrease the flight depth in the forward or metering section.

If one were to plot output vs. pressure at the die (screw characteristic) of several constant pitch screws, it would be noted that shallower flighted screws develop highest pressures. The output of a high CR screw is lower at low die pressures than that of a low CR screw. At different CR's output varies but primarily as a function of the flight depth, not the CR per se. Similar work has shown that increasing stock temperature on a high CR screw results in less increase in output than on a lower CR screw. Again the controlling difference was in the flight depth and not the CR. The shallower screw (high CR) showed less effect of barrel temperature non-uniformity and therefore did not require as close a barrel temperature control.

CR should not be overlooked completely, as it can be important. However, classifying screws merely by CR can be misleading.

(Continued from Page 1)

major lighting modernization on State Avenue, the State Capitol area, and other primary highways, at a cost of $200,000. While in Baton Rouge, another capital city, 833 obsolete lighting fixtures have been replaced with more than 5,000 new ones as part of a 6-year relighting program. The results: nighttime accidents have been reduced, law enforcement is far easier, Main Street business has increased, and the improved lighting has been a definite impetus to business development on other city streets.

Many cities are finding that their present systems are fast becoming obsolete and they are in need of major repairs, replacements, and overhauling. It is estimated that only about 15% of the nation's street lights have been replaced since 1937. Postwar developments by manufacturers and utilities have introduced more efficient systems which cost less to maintain and operate while providing light of far greater intensity.

With 85% of our lighting systems considered obsolete, and merchants and residents alike pushing for a more efficient lighting for comfort, safety, and sales incentive, the coming years should see these new systems installed on many of the nation's 350,000 miles of city streets.

ARE YOU ON OUR MAILING LIST?

Each month people who are interested in the wire industry receive a personal copy of the *Wire Recorder*. If you would like your own name, or others in your firm, added to the *Wire Recorder* mailing list, please drop a card to MONSANTO.

MONSANTO ®

MONSANTO CHEMICAL COMPANY

PLASTICS DIVISION—SPRINGFIELD, MASSACHUSETTS

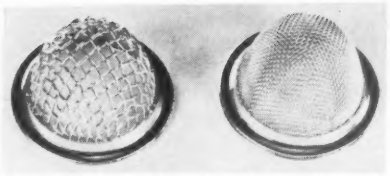


Photo 1—Ether masks made of fine wire mesh and thicker gage wire mesh, electro-polishing after assembly.

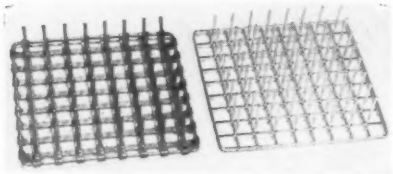


Photo 2—Bobbin guards used in textile mills, before and after electropolishing.

Various Cathodes Used: These are generally composed of copper, lead or stainless strips, wire or perforated metal. There are situations where the tank itself will serve as an adequate cathode. For units up to 500-gallon capacity, cathodes are commonly made of ⅛" by 1" metal strips. For larger units ¼" by 3" strips are preferable. These strips are adjustable and hung vertically in the bath.

★ ★ ★

Contour-type cathodes which conform to the shape of the part to be polished, give excellent surface polishing results, almost impossible to attain by mechanical polishing.

★ ★ ★

When using copper or copper alloys for holding racks, remember to remove from time to time the sludge of copper that forms on the cathodes.

Racking Small Parts: Where they can be hooked or clamped, you can polish these in batches by loading many parts on racks. Larger parts may have to be individually hung. In continuous high production the parts are clamped to a moving electrode system and unloaded continuously as in electroplating. The exact set-up is determined by the nature of the product to be polished.

★ ★ ★

For the most part special practices are not necessary. Hang the work in the tank with proper contact and the parts will polish. Problems of racking and current distribution are much the same as those of electroplating in a chromium bath.

★ ★ ★

Bath Contamination: Dirt, grease and other foreign matter will not affect the performance of the solution, but may cause foaming due to entrapped gases. This can be controlled by skimming off the foreign substances or by using a special de-foamer, such as Stenol or Ocenol, both duPont products.

★ ★ ★

Bath Additions: When making additions to the bath the difference in solution levels at the time of the drawing of the sample and again at the time of making the addition must be considered.

★ ★ ★

Armco offers two patented electropolishing methods using two different solutions. Both have a long record of successful electropolishing.

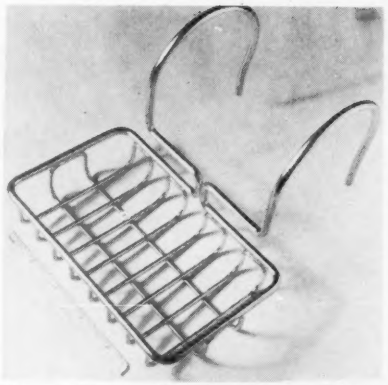


Photo 3—Wire articles like this soap dish are ideal for electropolishing.

Method 1

Advantages: A Glycolic-Sulfuric acid solution (duPont) electropolishing solution) is preferred. The initial solution cost is low, less than for Method 2.

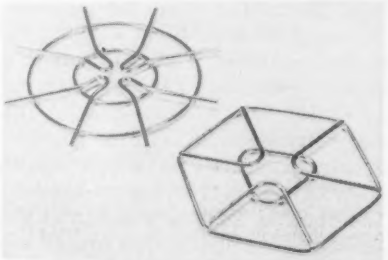


Photo 6—Electropolished "spiders" or grates for kitchen ranges.

★ ★ ★

Solution maintenance cost also is low. Solution replacement is less because most of the solution drag-out can be saved by a reclaim rinse

(*Please turn to page* 341)

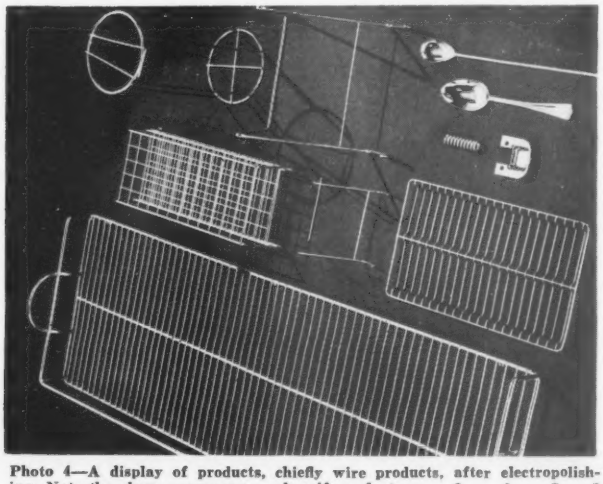


Photo 4—A display of products, chiefly wire products, after electropolishing. Note the clean appearance and uniform luster.

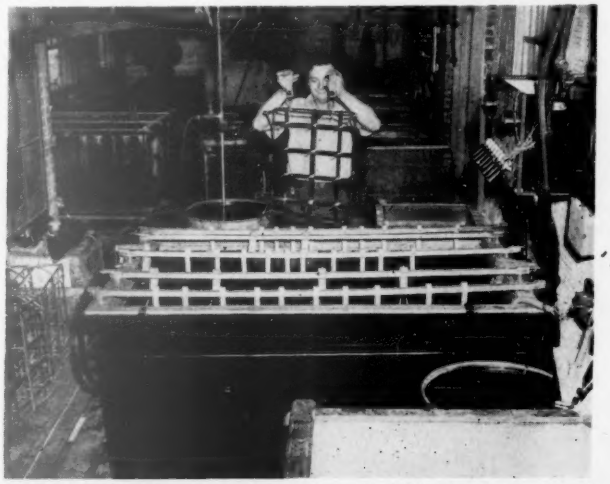


Photo 5—A 300-gallon unit used to electropolish bobbin boards.

Automatic Control of Furnaces Used in Wire Processing

By Leo Walter
Consulting Engineer
Eastcombe, England

Part A

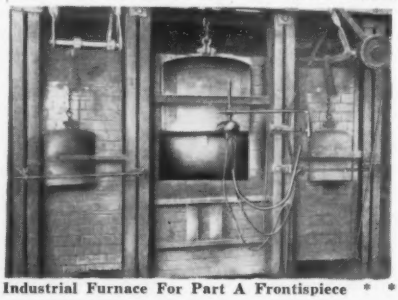
Fundamentals of Automatic Temperature Regulations of Industrial Furnaces

In Part B, that will appear in April, the author describes the automatic control of furnace construction and temperature.

Automatic temperature control of heat treatment furnaces is usually based on indirect methods. In other words, it is not possible to derive control action from the actual furnace charge temperature, unless radiated heat from the charge actuates a sensitive control element. What is usually measured is either temperature of the furnace atmosphere, or in larger heat treatment furnaces the temperature of the refractory material in the roof. It is assumed that these measured temperatures are closely related to the average charge temperature, and can, therefore, be used for thermostatic control purposes. Difficulties can be expected if the temperature difference between products of combustion, or of electrical resistor heating elements, and final temperature of the charge is considerable. Indirect temperature control would become impossible if this difference would change its relative value repeatedly. For example, if flame temperature would be 2600°F, but used to heat the stock up to only 1000°F, over-heating of the furnace material could occur long before the furnace chamber material or furnace atmosphere has reached the critical temperature, in spite of presence of an automatic pyrometer controller. Local over-heating can also occur near inlet ports for burner flames, or near resistors, and may sometimes be present due to lack of proper circulation of furnace atmosphere.

★ ★ ★

The main difficulty in furnace temperature control is correct location of the temperature detecting device, which in most instances for heat treatment furnaces is a thermocouple. Long practical experience rather than theoretical considerations are helpful for determination of thermocouple position, and combined efforts for correct location on part of the makers of the furnace, of the user, and of the specialized instrument engineer are often required. Rapid circulation of furnace gases not only improves uniform heat distribution in the charge, but increases controllability of a heat treatment furnace by cutting down the heat distribution time lag. Likewise correct location of photo-electronic elements measuring heat radiation is important for close control.



Industrial Furnace For Part A Frontispiece * *

Classification of Controllers

The power medium for temperature control instruments can be compressed air, water or oil under pressure, or electricity. The use of the latter has become more common since the introduction of electronic magnification of control impulses. The primary or detecting element detects and measures temperature variations, and ascertains thus deviations of measurement from the desired temperature value. A control mechanism then transforms and magnifies the control impulse, and a regulating unit or final control element produces control action in form of movement of a regulating unit which may be a control valve or a flue damper. (Fig. 1). A temperature controller

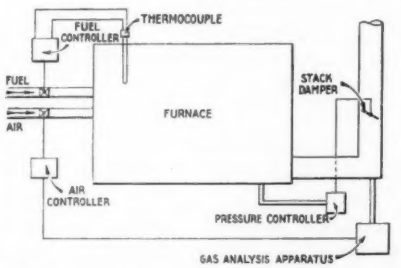


Fig. 1—Simplified Hook-up of Furnace Control System, including Stack Damper for Pressure Control. * * * * * * * * * * * * *

can thus be power operated, i.e., it can be of the pneumatic, hydraulic, or electric type. Below 800°F a gas-or-vapour-filled contact dial thermometer can be used, or a thermostat switch can actuate a magnetic or motorized valve. At higher temperatures sheathed thermocouples are used. For temperatures above 900°F usually radiation pyrometers have to be applied for measurement of furnace temperature. For existing furnaces one or more test runs can ascertain the best location of a thermocouple which is most closely related to the temperature of the charge at the lowest point of the latter. The general ruling should be to try to detect the furnace temperature which is most closely related to the lowest charge temperature and to place the temperature-sensitive element there.

Minimum Information of Furnace Characteristics

The controllability of a process determines the minimum information that is wanted for choosing the right control mechanism. There are simple control problems encountered in furnace control where very few data are required, especially when relatively large deviations from the temperature control point can be tolerated by the user. Other furnace control problems require much detailed information, and might make prolonged experiments with hand control necessary in order to secure basic information on an existing uncontrolled furnace. The preliminaries to fitting controls therefore vary widely, from filling in a "data chart" provided by the manufacturers of controllers up to elaborate tests and calculations.

★ ★ ★

Whilst the choice of control mode is mainly the job of the control expert, the user of an industrial furnace generally has to state the accuracy at which he wishes to maintain control. Great caution has to be exercised by the potential user of instruments for automatic furnace control before expressing his wishes. Accuracy of control depends primarily not on what the user of a control mechanism wishes to obtain, but on what the heating process will allow. In other words, the furnace user must know the degree of controllability of his process, and keep within the limits when stating his claims for accuracy (Fig. 2). Furthermore, accuracy of control is obviously closely related to financial expenditure, because in general, the more accurate the control required, the more elaborate the control mechanism must be, and first cost and maintenance expenditure rise accordingly. If the user is willing to tolerate certain bigger deviations of the controlled variable (temperature), from the set point, the choice of control instrument is thereby made easier.

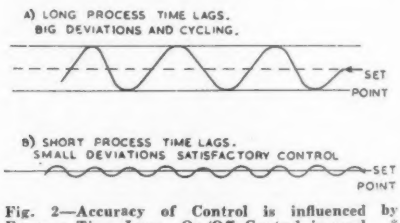


Fig. 2—Accuracy of Control is influenced by Furnace Time Lags. On/Off Control is used. *

Process Analysis in Practice

Before fitting temperature regulators to an existing industrial furnace, the method of operation of gas or oil burners, or of electric resistance elements by hand control should be carefully studied during normal working operations. A survey of charges of required temperatures for each charge and material, and actual temperature readings at regular intervals should be entered into log sheets, which latter should be placed at the use of the supplier of the furnace control system. Some smaller and medium-sized heat treatment furnaces will work very well with On/Off or two-step control, using either low heat input or high heat input. Other medium-sized heat treatment furnaces for annealing, stressing, etc. might require gradual temperature control, whereby the rate of heat input is varied according to the actual heat demand from the furnace charge. Pneumatically, hydraulically and electrically operated gradual heat controllers will be required in order to avoid too heavy temperature fluctuations during processing. Modern electronic temperature controllers possess good inherent accuracy and stability.

Temperature Control Instruments

Automatic controllers for furnace temperature can be grouped as follows:—

(a) Contact thermometers using liquid filling (mercury), gas filling or partial filling with vapour pressure action. They are used for low temperature work and for smaller furnaces of the tool-room, metal treatment workshop and the like.

(b) Metal Pyrometers, using metal expansion (rod and tube, bi-metal helix, etc.) having metallic contacts or tilting mercury vacuum tube switches, may be used for lower temperatures.

(c) Chopper bar galvanometer or Potentiometer controllers, whereby a chopper bar is depressed at regular intervals by means of a mechanical clockwork or a small electric motor, thus making either plus or minus contact, have been widely installed. The small impulse current is electrically or electronically magnified in a relay, and a larger force is thus released which may be electric, pneumatic, or hydraulic for operation of a regulating unit.

(d) Electronic controllers, using electronic tubes or valves for magnification of control impulses from a thermocouple or electrical resistance instrument, are being applied in increasing numbers.

(e) Optical pyrometers are, of course, standard in high temperature work.

Choice of Controller Types (Fig. 3)

Briefly, the factors influencing selection of control method and of controller type are as follows: (1) cost price of instrumentation in relation to achievable economies. Usually the first installation cost of a new instrument group is related to the cost of the furnace itself, to the nature of the material heated, to the achievable improvement in quality of treated goods, and to fuel consumed. Obviously, if 1% to 2% of the cost of a new large heat treatment furnace are allocated for instrumentation, the latter can be elaborate. The same percentage allowed for a small tool-room furnace will only allow a low-priced contact-pyrometer for two-step (on/off) mode to be used. (2) As regards accuracy of control, the requirements by the potential instrument user should not be exaggerated, because closeness of control has to keep within the inherent controllability of the furnace itself, and also because the closer control is required the more elaborate and costly becomes the contact gear.

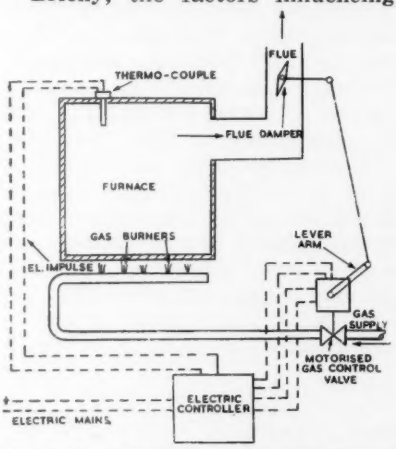


Fig. 3—Gas Control Using Motorized Control Valve with Lever Arm for Damper Regulation *

★ ★ ★

(3) **For** larger furnaces, the number of thermocouples depends on furnace design, number of burners or electric resistors, and the like. For batch type furnaces all burners should be controlled, be-

cause otherwise excess heat might be produced in charge section close to an uncontrollable burner. (4) Combustion control should be fully automatic where fuel oil or producer gas is used, or for medium-sized furnaces using towns gas. Pulverized coal firing also lends itself very well to control from thermocouples. Coal grates or stokers might sometimes be semi-automatically controlled, i.e. draught-control only with CO_2 and CO plus H_2 measurement, and the like. There are, however, very elaborate fully automatic control schemes in operation with time-temperature or programme control such as for soaking pits, open hearth furnaces, annealing types and so on. (Fig. 4).

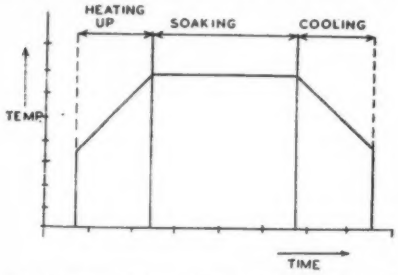


Fig. 4—Time—Pattern Curve For Soaking Pit.

Controller Design and Function

The user of automatic control instruments is usually less concerned about design and function of a controller, but is mainly interested what the instrument will do for him. Nevertheless, a fundamental knowledge about controller design and function is essential, because (a) during practical control operation certain adjustments on installed instruments might become necessary, and (b) efficient instrument maintenance requires a good knowledge of design and functional operation, (c) sometimes minor repairs can be performed locally if the cause of minor instrument troubles can be quickly located, and efficient quick trouble shooting can save a lot of money. Each temperature controller, irrespective of type and make, consists essentially of (Fig. 5): A temperature-sensitive detecting element, which can be a mechanical thermometer element, a resistance thermometer, or a thermocouple or thermo-pile. This element sends measuring impulses to the control mechanism, which consists of a measuring and a controlling section. The control impulse is amplified, either by mechanical (pneumatic or hydraulic relay) action, or electrically or electronically. The final control element or regulating unit in form of a power-operated control element may be a valve, a damper, a power-cylinder, etc. This control unit then performs the ultimate actual control operation. Fig. 6 shows a typical power cylinder for operating stack dampers, or large valves or electrical control gear.

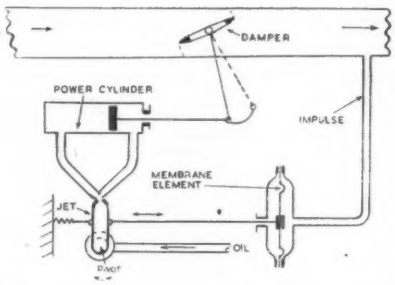


Fig. 6—Oil-jet Operated Power Cylinder Regulates Gas Flow to Burners.

The Temperature Impulse

Quick and correct detection of deviation of charge temperature from the desired value (or set temperature) is an essential pre-requisite for close control. Correct location of the right type of temperature sensitive element requires experience, and also co-operation from the designer of a furnace with the control engineer. For a new plant co-operation should start preferably in the early drawing board stage. The furnace designer and the instrument engineer know that the smaller the time lag is between occurrence of a temperature deviation and its measurement, i.e. the quicker movement within the control mechanism is initiated, the better can control action be performed. It is not always easy to locate a thermocouple or mechanical pyrometer correctly, because in furnaces considerable temperature differences of furnace space and of the charge can be encountered. Although it is not absolutely necessary to measure the actual charge temperature, which by the way is often impossible, temperature control can nevertheless be fairly satisfactory as long as the measured temperature is and remains strictly related to the actual charge temperature. Falsification of temperature measurement by means of thermocouples requires special precautions, such as compensation leads, or the use of 2 thermocouples, and other measures to derive control action from the real average charge temperature.

* * *

It can be safely assumed that control results will be satisfactory if the measuring point has been selected so that changes in rate of heat input are quicker indicated at point of measurement than in the furnace charge. This anticipating effect is invaluable to compensate for time lags in general. Automatic temperature control of electric furnaces using on/off or high/low control mode has to compromise between two divergent requirements. First, the desire is to keep the temperature differential between on and off as small as possible. Too frequent contact making will, however, shorten the time of life of contactors, and of contacts

(*Please turn to page* 338)

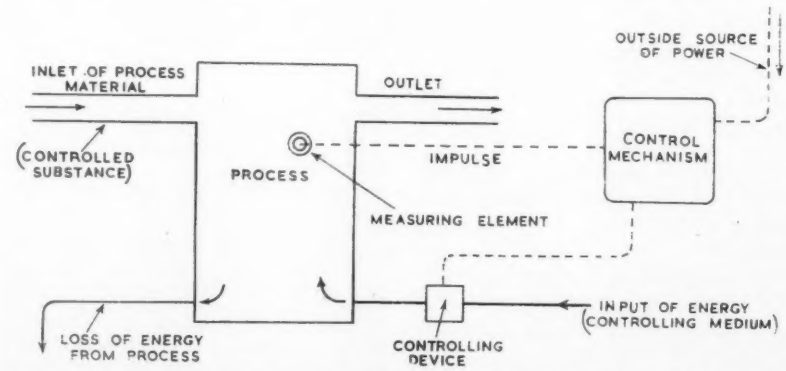


Fig. 5—Elements of Automatic Furnace Control, shown on Continuous Process.

Effects of Cold Work and Annealing Temperatures on the Grain Size and Hardness of Various Types of Copper Wire

By C. H. Hannon, Metallurgical Engineer
Transformer Laboratories Department
General Electric Company
Pittsfield, Massachusetts

This important study on copper wire represents a great amount of research and is an invaluable contribution that we are happy to be able to publish for the benefit of copper wire drawers and users. Mr. Hannon has been a member of The Wire Association for many years and is a former Director of the Society.

A thorough knowledge of the grain size and structural characteristics accompanying the changes in physical properties developed in a material by various combinations of working and annealing treatments are fundamentals. On these fundamentals we can base an understanding and interpretation of methods and technique by which maximum desired properties can be attained.

★ ★ ★

Results reported on cold-worked copper show that oxygen-free copper produced by melting and casting in a reducing atmosphere "Type A-OF", oxygen-free copper made by briquetting, coalescing and hot extrusion "Type B-OF" and tough pitch electrolytic copper attain a large grain size with increasing annealing temperature in the order named. Type A is characterized by relatively uniform grain size at all temperatures, while the structures of both Type B and tough pitch copper are markedly non-uniform once rapid grain growth has begun. The grain size range of the two oxygen-free coppers are very nearly the same at the higher temperatures (850 and 900°C), while that developed in tough pitch copper at these temperatures is extremely large. Indications are that if we desire to keep the grain size down on the oxygen-free coppers, we must use a lower annealing temperature than permissible on tough pitch electrolytic.

★ ★ ★

Hardness data show an interesting phenomenon: a second drop in hardness with increasing temperature, well above the drop in hardness which occurs at the recrystallization temperature. This second drop in hardness occurs at the temperature where there is a rapid increase in the rate of grain growth. The temperature for secondary softening, and the amount of it, appear as distinguishing features of the different types of copper, and are probably measures of their respective impurity composition and distribution.

★ ★ ★

There has been considerable interest in wire quality, rolling behavior, winding characteristics, annealing characteristics and physical properties of the oxygen-free types of copper as compared to tough pitch copper. Quality and consistency of quality can be determined by routine tests and inspection over a considerable number of lots, but rolling behavior and winding characteristics can only be determined by actual manufacturing experience. Annealing characteristics and physical properties can be determined by means of laboratory tests.

★ ★ ★

By fabricating trial lots of oxygen-free and tough pitch copper through typical wire manufacturing operations, we have gained experience and know what to expect in the way of quality and rolling behavior from various brands of copper. Tests on the annealing characteristics of these materials have been completed and the data is presented herein.

Materials and Preparation of Samples

The original series of tests was made on lots of rectangular copper wire which had been subjected to cold drawing and cold rolling to give high percentages of cold reductions. The results of these tests indicated the advisability of a second series of tests on round wire samples to eliminate the variable of the gradient in the degree of cold work caused by rolling a round to a flat, and also to extend the study to smaller cold reductions.

★ ★ ★

Rectangular wire samples (0.500 x 0.050) for the original series of tests were made from the following kinds of copper:

1. **Tough Pitch—electrolytic (ETP)**
2. **Oxygen Free High Conductivity; Type A-OF (melted)**
3. **Oxygen Free High Conductivity; Type B-OF (coalesced)**

★ ★ ★

Each of these had total cold reductions in area (by drawing and rolling) of 94, 85, 77 and 68%.

★ ★ ★

For the second series of tests, copper bull ring wire was drawn to give a series of cold reductions. In drawing wire, the dies are of such size that the wire is reduced one B&S gage number in passing through successive dies. For convenience, these reductions will hereinafter be shown as B&S numbers between the starting size and any particular finished size. The reduction expressed in percentage cold reduction as compared to B&S

numbers are as follows:

B&S No.	Per Cent Reduction
1	20
2	37.5
3	50
4	60
5	68.5
6	75
7	80
8	84.5
9	87.5
10	90
11	92.25
12	93.75
13	95

★ ★ ★

Round samples for the second series of tests included the following kinds of copper: — drawn to indicated B&S nos. hard.

1. **Tough Pitch 3, 4, 5, 6, and 7.**
2. **Type A oxygen-free 1, 2, 3, 4, 5, and 6.**
3. **Type B oxygen-free 1, 2, 3, 4, 5, 6, and 7.**

Annealing Procedure

In annealing, the samples were held at temperature for one hour to assure their reaching equilibrium conditions. All samples were annealed simultaneously at any given temperature, except for the three highest temperatures. The anneals at 550, 600, 650, 700, and 750 degrees C were made in a fused salt bath, after which the samples were water quenched from temperature. The anneals at 800, 850, and 900 degrees C were made in an electric furnace, after which the samples were air cooled. At the three high temperatures the oxygen-free types were annealed in a reducing atmosphere (an attempt was made to obtain a neutral atmosphere, but the tough pitch samples were embrittled and subsequent investigation showed the atmosphere composition to be 1% H_2, 4% CO, 15% CO_2, bal. N_2). The embrittlement of the tough pitch necessitated duplication of the samples by annealing in air.

★ ★ ★

Partial results indicated the advisability of annealing a series of samples at lower temperatures (200, 300, and 400 degrees C) to complete the hardness curve. The round samples were used for this purpose. All samples in this test were tightly wrapped in copper foil and annealed in an electric furnace with air atmosphere. The foil wrapping practically eliminated oxidation of the samples.

Results

Hardness measurements were made on all samples and are reported as Rockwell Superficial 15-T scale values.

★ ★ ★

A cross section of each sample was taken, mounted, polished and microscopically examined. Longitudinal sections were made of a few samples to check the uniformity of samples. Grain size measurements were made where possible. Characteristic samples of any given condition were photographed.

★ ★ ★

Within the usual range of cold reductions by drawing (3 to 7 B&S numbers hard), the temperature at which a rapid increase in the rate of grain growth occurs is the lowest for Type A copper, being about 550 degrees C for the greater reductions and about 600 degrees C for the smaller reductions. For Type B copper this temperature is somewhat higher, being about 600 degrees C for the larger reductions and about 700 degrees C for the smaller reductions. It is appreciably higher for tough pitch copper, occurring at a temperature of 700 degrees C for the larger reductions and at 800 degrees for the smaller reductions. Within the usual range of cold reductions in rolling an annealed round wire to a flat (equivalent to 1 B&S number hard), the temperature at which rapid grain growth occurs is about the same for Type A and Type B coppers, being about 700 degrees C; while for tough pitch it is higher than 800 degrees C.

TABLE I

GRAIN SIZE DATA
ROUND SAMPLES

Annealing Temperature °C — B&S Nos. Hard →	0	1	2	3	4	5	6	
Tough Pitch Electrolytic								
As Rec.	.017							
550				.021	.020	.019	.018	.017
600				.023	.022	.021	.020	.019
650				.025	.024	.023	.022	.020
700				.027	.026	.025	.025	.024
750				.038	.03-2.5	.03-1.0	.03-1.0	.03-1.0
800				.065	.06-2.0	.06-2.0	.04-1.5	.04-1.5
850				.06-2.0	.06-3.0	.06-3.0	.04-1.0	.04-1.0
Type A oxygen-free								
As Rec.	.036							
550	.045	.045	.045	.045	.045	.065	.065	
600	.04-.09	.055	.055	.04-.15	.04-.15	.04-.15	.04-.20	
650	.06-.15	.065	.06-1.0	.06-.50	.06-.20	.12	.12	
700	.10-.30	.10	.10-0.3	.10-.30	.10-.30	.10-.30	.10-.20	
750	.10-.40	.10-.70	.10-1.0	.10-.50	.10-.50	.10-.50	.10-.50	
800	.15-.60	.15-.60	.15-0.6	.15-.60	.15-.60	.15-.60	.15-.60	
850	.20-.70	.20-.70	.20-0.7	.20-.70	.20-.70	.20-.70	.20-.70	
900	.25-.80	.25-.80	.25-0.8	.25-.80	.25-.80	.25-.80	.25-.80	
Type B oxygen-free								
As Rec.	.038							
550	.03-.09	.03-.09	.03-.09	.035	.035	.035	.035	.02-.12
600	.03-.20	.04-.09	.03-.07	.03-.07	.03-.07	.03-.30	.03-.09	.02-.12
650	.03-.20	.03-.12	.03-.07	.03-.17	.03-.07	.03-.40	.03-.40	.02-.20
700	.03-.40	.04-.12	.03-.10	.03-.10	.03-.12	.04-.30	.03-.20	.03-.20
750	.03-.60	.05-.15	.03-.20	.03-.20	.03-.30	.04-.30	.04-.20	.04-.20
800	-	-	-	.05-.30	.05-.50	.05-.30	-	-
850	-	-	-	.05-.40	.05-.60	.05-.50	-	-
900	-	-	-	.05-.80	.05-.80	.05-.60	-	-

TABLE II

GRAIN SIZE DATA
FLAT SAMPLES

Annealing Temperature °C — Reduction in area →	68	77	85	94
Tough Pitch Electrolytic				
550	.025	.025	.025	.027
600	-	-	-	-
650	.039	.038	.035	.036
700	-	-	-	-
750	.03-1.2	.03-1.0	.03-2.0	.03-.20
800	-	-	-	-
850	-	-	-	-
900	.03-1.2	.03-1.2	.03-1.2	.03-.70
Type A oxygen-free				
550	.035	.035	.035	.040
600	-	-	-	-
650	.06-.20	.06-.15	.06-.15	.090
700	-	-	-	-
750	.12-.60	.12-.30	.12-.30	.12-.30
800	.2 -.6	.2 -.6	.2 -.6	.2 -.6
850	.2 -.6	.2 -.6	.2 -.6	.2 -.6
900	.2 -.8	.2 -.8	.2 -.8	.2 -.8
Type B oxygen-free				
550	.035	.035	.035	.033
600	-	-	-	-
650	.04-.09	.04-2.0	.04-2.0	.043
700	-	-	-	-
750	.04-.20	.04-0.20	.04-0.30	.04-1.0
800	.04-.40	.04-0.40	.04-0.40	.04-1.0
850	.04-.40	.04-0.40	.04-0.40	.04-1.0
900	.1 -.40	.06-1.0	.06-1.0	.06-1.5

The structure of Type A copper during grain growth is characterized by relatively uniform grain size at all temperatures. From the start of grain growth, the structure of Type B tends to be definitely non-uniform, some grains being quite large and others in the same sample remaining very small, this condition persists up through 900 degrees C. The structure of tough pitch is uniform during the early stages of grain growth, but upon reaching the temperature at which a rapid increase in the rate of grain growth occurs it changes quite suddenly to a very large grain size, with parts of the sample remaining small grained. This non-uniformity in tough pitch is largely removed at a temperature of 850 degrees C.

★ ★ ★

Grain size measurements were made on all samples where possible. However, due to the non-uniformity of many of the structures at the higher temperatures, much of the data is necessarily given as a range of sizes rather than as a single average value. Tables I and II give the detailed grain size data for all conditions of the materials tested. The accompanying photomicrographs, Fig. 1, are self-explanatory and are representative of the grain growth characteristics of the three types of copper annealed in the range of 550 to 900 degrees C.

★ ★ ★

Detailed hardness data is given in Tables III and IV for all conditions of the materials tested. The horizontal line drawn on these tables represents the point for any given degree of cold work where the grain size is noticeably changing from small to large. This line (on Table III where there is a wide range of cold reductions) shows a lowering of the temperature at which rapid grain growth occurs with increasing degrees of cold work.

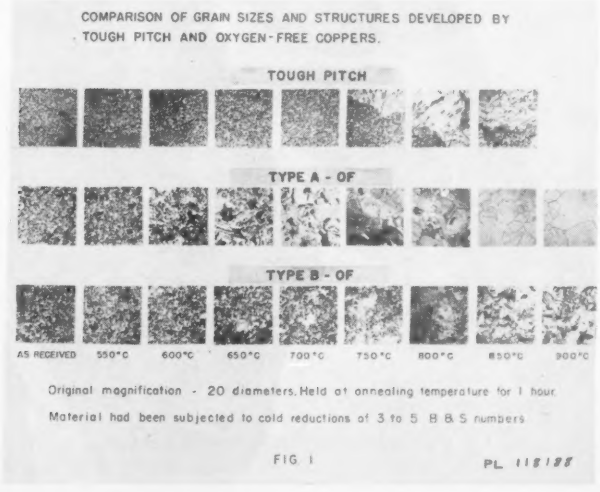
★ ★ ★

Fig. 2 is a graph of the Rockwell Superficial hardness values and maximum grain size developed at a given temperature plotted against the annealing temperature. It can be seen that the temperature at which a rapid increase in the rate of grain growth occurs is also the temperature at which there is a marked decrease in hardness with increasing temperature. The transition from small to large grain size in Type A copper is gradual and correspondingly the softening with increasing temperature is gradual. While for Type B and tough pitch copper the transition from small to large grain size is more abrupt, correspondingly the hardness curves show a distinct break at that point. The annealing temperatures shown are well above the recrystallization temperature, so this secondary softening should not be confused with the softening accompanying recrystallization (see Fig. 3).

Discussion of Results

By applying the following six concepts we are able to explain the behavior of the three types of copper when heated to temperatures well above their recrystallization temperatures. It is interesting that very similar concepts have been found to explain the secondary grain coarsening behavior of other commercially pure materials, as for example, aluminum for thin foils, and pure iron-silicon alloys for magnetic strip.

1. **A cold worked material is subject to grain growth when heated to a temperature above its recrystallization temperature. The grain size developed is larger the higher the heating (annealing) temperature and upon heating at some elevated temperature there is a rapid increase in the rate of grain growth.**



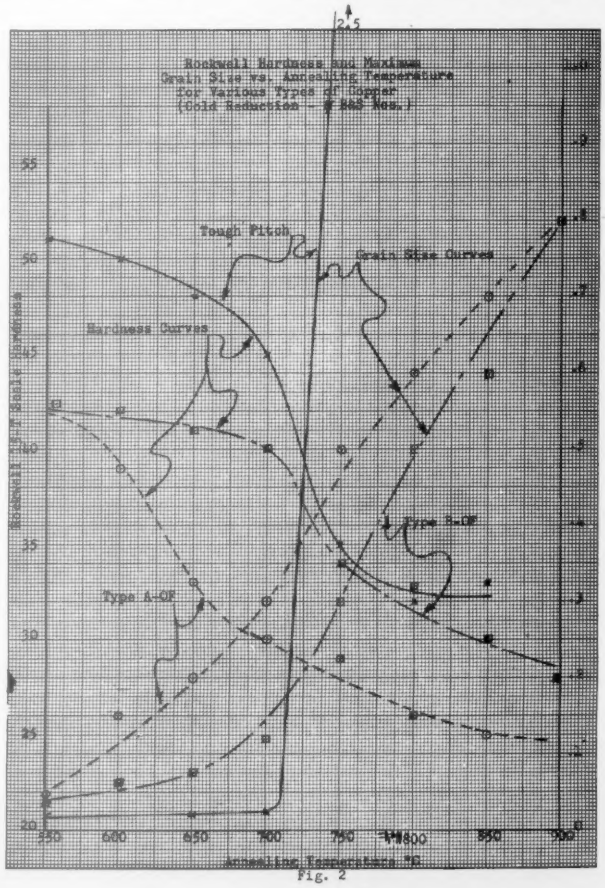

Rockwell Hardness and Maximum Grain Size vs. Annealing Temperature for Various Types of Copper
Tough Pitch
Grain Size Curves
Hardness Curves
Type A-OF
Annealing Temperature °C
Fig. 2

TABLE III

ROCKWELL SUPERFICIAL HARDNESS

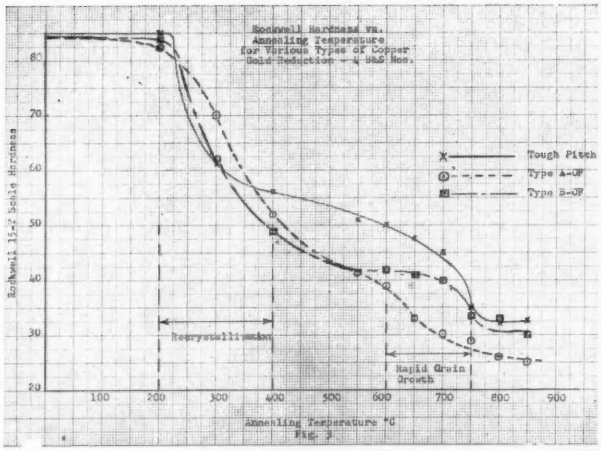
ON ROUND SAMPLES

Annealing Temperature °C	B&S Nos. Hard → 0	1	2	3	4	5	6	7
	Tough Pitch Electrolytic							
200				85	85	86	86	82
300				61	61	61	60	62
400				57	56	55	56	57
550				50	51	53	54	52
600				51	50	50	52	49
650				48	48	48	50	47
700				49	45	46	41	43
750				40	35	36	35	35
800				38	32	36	35	33
850				33	33	35	34	34
	Type A oxygen-free							
200			83	84	--	83	82	81
300			80	80	80	70	64	61
400			50	51	54	52	52	46
550		50	45	44	42	42	39	37
600		41	43	43	40	39	31	30
650		36	42	40	30	33	29	25
700		38	39	32	31	30	*	*
750		32	33	30	31	29	*	*
800		31	30	28	26	26	*	*
850		24	26	21	21	25	*	*
900		26	23	24	23	28	*	*
	Type B oxygen-free							
200			84	84	84	84	85	57-78	52-79
300			81	79	71	62	60	56	53
400			48	47	47	49	47	49	46
550		52	42	43	43	42	44	39	38
600		38	41	44	43	42	42	40	36
650		37	41	42	41	41	41	40	30
700		39	41	41	39	40	35	33	28
750		35	35	36	35	34	33	30	26
800		33	36	35	34	33	29	29	26
850		33	35	34	33	30	29	26	24
900		33	34	33	27	28	24	23	20

* Erratic readings.

Note: Apparent decrease in hardness (see Type A and Type B) with increasing degrees of cold work is not a true picture, as the wire diameter is smaller, giving a lower hardness value for same "real" hardness.

Note: The horizontal line represents the point at which the transition from small to large grain size is apparent. * * * * *



2. **When foreign materials or impurities are present they tend to inhibit the start of rapid grain growth, or in other words, they raise the temperature at which a rapid increase in the rate of grain growth occurs.**
3. **The temperature at which a rapid increase in the rate of grain growth occurs in a metal will be higher the greater the amount of foreign material it contains.**
4. **Quoting Eastwood, Bousu and Eddy: "An obstruction material when present in an annealed material raises the minimum temperature of coalescence (temperature at which a rapid increase in the rate of grain growth occurs), with the consequent formation (upon coalescence) of larger grains than are produced in a similar metal at the same temperature without the obstruction material."**
5. **When the foreign material is non-uniformly distributed (segregated) it causes grain growth to proceed non-uniformly when it does take place. At a given temperature, an area with a low concentration of foreign material may be subject to rapid grain growth, while an adjacent area with a high concentration of foreign material is still below the temperature at which a rapid increase in the rate of grain growth occurs.**
6. **If the segregated areas of high foreign material concentration are close together, the intervening areas of low foreign material concentration are necessarily limited in size. If this metal is heated to a temperature at which the areas low in foreign material are subject to rapid grain growth, the resultant grain size may be smaller than that of a pure metal heated to the same temperature, because grain growth cannot proceed into areas of high foreign material content.**

★ ★ ★

It has been observed that Type A copper (OF), made by melting and casting in a reducing atmosphere, is very clean with a minimum of foreign material and less than 0.02% dissolved impurities in it. This type has very little in it to prevent the start of grain growth, so in accordance with concept #1 it starts soon after recrystallization and proceeds fairly uniformly with increases in the temperature of heating (see Fig. #1).

★ ★ ★

The Type B copper was manufactured by producing brittle cathode sheet (inherently containing inclusions of foreign material), breaking up the sheet, washing the particles, briquetting, heating in a deoxidizing gas and extruding. Due

(*Please turn to page* 336)

TABLE IV

HARDNESS DATA

FLAT SAMPLES

Annealing Temp. °C	Reduction in area →	Type A 94	85	77	68	Type B 94	85	77	68	Tough Pitch 94	85	77	68
550		56	56	56	53	55	55	55	56	56	55	54	56
650		50	51	50	51	54	54	54	55	56	55	56	55
750		46	45	47	47	50	48	50	50	52	49	49	51
800		43	44	43	43	50	46	45	45	x	x	x	x
850		43	43	43	42	46	45	45	45	x	x	x	x
900		40	40	38	41	45	42	45	44	48	46	46	47

x Seem to be embrittled.

Note: The horizontal line represents the point at which the transition from small to large grain size is apparent. * * * * * * * * * * * *

ELGIN DIAMOND

meets rigid quality standards

at Allegheny Ludlum Steel Corporation, Pittsburgh

When wire is pulled through carbide dies, tremendous heat and pressure are generated. That is why the working surfaces of wire drawing dies must be polished to a near perfect finish. That is why Allegheny Ludlum uses Elgin Diamond.

Elgin Diamond assures the finest possible finish—and in less time—because all Elgin Diamond is precision graded and permanently suspended in a color-identified compound right in the Elgin laboratories. There are no oversize particles to scratch, no "fines" to decrease cutting efficiency.

Hundreds of die finishing applications prove Elgin Diamond reduces costs and produces a better finish every time . . . in less time! Now is the time to try Elgin Diamond and prove it to yourself!

Ask for a free demonstration!

ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

Dept. G

ELGIN, ILLINOIS

A New Design of Wire Tester For Measuring the Torsional Yield Point of Spring Wires

By W. R. Johnson, Metallurgist
Associated Spring Corporation
Bristol, Connecticut

This device, developed at the author's company, has been found useful in predicting Spring Set performance from wire properties and should be of interest to wire producers and spring formers.

Our company has developed a new design of wire tester to measure the torsional elastic limit of spring wires. The tester is a simple device that is designed to twist a known length of wire about its axis through a known degree of angular deflection. When the load is released, the amount of permanent deflection or "set" in the wire is measured. When the angular set reaches an amount equal to 2% of the angular deflection that was given in the test, that value of deflection is arbitrarily called the "2% set point."

★ ★ ★

No load measurements are taken; the stress is computed from the wire dimensions and the deflection by the following formula:

★ ★ ★

For steel wire, the stress is equal to 1000 times the deflection in degrees when the wire test length is equal to 100 times the wire diameter.

Significance

The spring maker's most commonly used inspection technique for quality control of incoming spring wire is the tensile test. It is rapid, reproducible, and over the years tensile test data have provided a set of quality standards which is quite workable. However, trying to predict spring performance from a tensile test is, to exaggerate mildly, like trying to determine which boy swiped a piece of pie by measuring the diameter of his waist line. It is not necessarily a pertinent measurement, it is not sufficiently sensitive, and it is meaningful only in the light of previous data.

★ ★ ★

A helical compression spring is stressed in torsion; it may fail in service by setting, that is, exceeding the torsional yield point. The value of the torsional yield point is therefore a design criterion that may be used directly in calculating the load a spring can safely carry without excessive set.

★ ★ ★

This value cannot be determined in a straightforward tensile test. Also it is far more sensitive than is the tensile strength to variation as a result of such spring-making procedures as wire-straightening, coiling and heat treating.

★ ★ ★

The surest way of checking a critical spring design is to make sample springs, but if we know accurately the pertinent characteristics of the spring wire, including its torsional yield point, calculations of a spring design can lead to production springs that are "right on the nose."

★ ★ ★

Measuring the tensile strength of a wire is easy; it is calculated from the number of pounds necessary to break the wire. But yield points, either in tension or in torsion, are a question of definition. A very loose definition for the spring maker is that the yield point is exceeded when an additional increment of load causes excessive permanent set. Measurable and acceptable loss of free height may occur in a compression spring with comparatively light loads, because of non-uniform stresses and variations in ends, but a workable definition of yield point is **that stress which causes a set equivalent to 2% loss of deflection or 2% loss of load.**

$$\text{Stress (psi)} = \frac{\pi \text{ GD} \times \text{deflection}}{360 \times L}$$

where G = modulus of rigidity,
D = wire diameter, in in.
L = length of test wire, in in.
Deflection = twist applied to wire, in degrees

★ ★ ★

This will result in the complication that some spring designs will set several thousandths of an inch at stresses under the yield point, while others will not set a detectable amount, depending on the deflection under load.

★ ★ ★

To measure this torsional yield point of all incoming spring wire, our new tester was developed.

Method of Use

To use the new wire tester, we choose a length of test wire which may be 100, 200, or more times the wire diameter, using as great a length as is feasible. The measured test length is delimited by right angle bends, and the sample is clamped in place between a fixed upper jaw and a movable lower jaw of the tester. If necessary, the lower jaw can be weighted to hold the wire partially straight, although this is not critical.

★ ★ ★

Load is applied manually to a given degree of deflection and then released; the reading at no load gives the torsional set of the wire. Loading is again applied with increased deflection in regular steps, until the set in degrees exceeds

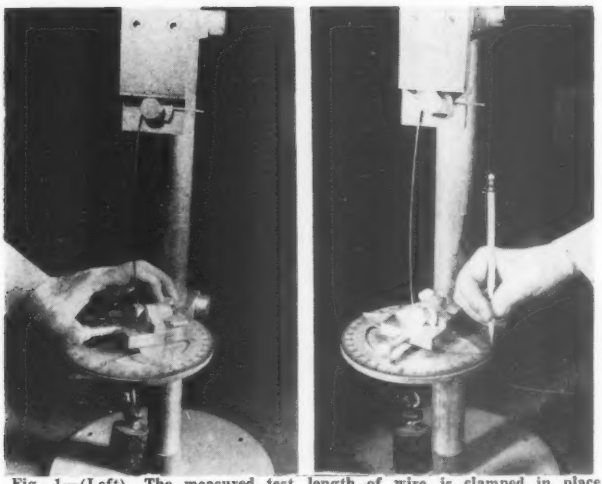


Fig. 1—(Left) The measured test length of wire is clamped in place between a fixed upper jaw and a movable lower jaw. The wire is twisted manually to a given degree of deflection and then released. (Right) The amount of angular deflection which remains after the twisting load is released is the torsional set of the wire. The twisting action is repeated with increased deflection in regular steps until the set exceeds 2% of the deflection.

2% of the deflection in degrees. A set of one degree is easy to detect, and readings of ½ degree can be approximated. The values are quite reproducible.

★ ★ ★

We have carried out many tests, comparing the torsional yield point of the spring wire to the set point of springs made from the wire. Since spring-making procedures strongly affect the torsional yield point of the wire, it may be necessary to heat treat the wire prior to test. For example, hard drawn wires, such as music wire, may show an increase in yield point of 50% or more after a 450° heat treatment, while the tensile strength is increasing 5 to 10%. On the other hand, oil tempered wires will not change on heat treatment.

★ ★ ★

Some typical data obtained by such tests on high tensile music wire are included in Table I.

★ ★ ★

It has been noted on many tests that the 2% set point of the wire is consistently lower than the 2% set point of the spring if the stress is corrected by the Wahl correction formula. The stress picture in the wire torsion tester is relatively uncomplicated torsion; the stress picture in a compression spring is very complex, with the material on the ID of the spring carrying much more of the load than the outer fibers elsewhere. With the differential loading that exists in an actual spring, it is not surprising that the discrepancy exists. For practical purposes, the set point as measured on the wire agrees quite closely with the set point measured on springs of indexes around 8 to 10, when the simple spring formula is used:

$$S = \frac{8\,PD}{\pi d^3}$$

For example, the springs made of the wire described in Table I had set points in the ranges shown in Table II, when the stress was calculated without the curvature effect.

★ ★ ★

The wire torsion yield point tester has been quite useful in predicting spring set performance from wire properties. Springs designed with the solid stress equal to the 2% set point measured on the wire will lose about 1½% of the load in a set out operation. The tester has also proved to be a sensitive device for following wire development research. Ultimately, it may be possible to use such a tester as a wire quality control technique to yield data directly applicable to spring design problems.

TABLE I

WIRE DIAMETER	.079"	.049"	.047"	.030"
Tensile strength, psi	320,000	361,000	359,000	398,000
Tensile strength after 450° H. T., psi	338,000	378,000	372,000	415,000
2% Set point of wire, psi	70,000	95,000	100,000	105,000
2% Set point of wire after 450° H. T., psi	145,000	160,000	170,000	180,000
2% set point of spring after 450° H. T., psi (corrected stress)	170,000	185,000	190,000	220,000

TABLE II

WIRE DIAMETER	.979"	.049"	.047"	.030"
2% set point of wire after 450° H. T., psi	145,000	160,000	170,000	180,000
2% set point of spring after 450° H. T., psi:				
Index 10	150,000	165,000	165,000	190,000
Index 5	130,000	145,000	155,000	160,000

THE WIRE ASSOCIATION

Invites wire men to join the organization and participate in its activities.

Write for a booklet on what it is and how it functions to

RICHARD E. BROWN
Executive Secretary

453 MAIN STREET **STAMFORD, CONN.**

Chronology of Cobalt

By Dr. F. R. Morral
Division Consultant
Metallurgical Engineering Division
Battelle Memorial Institute
Columbus, Ohio

A Cobalt Information Center has been established at Battelle under the direction of the author. World production of cobalt has nearly doubled in the last five years, about 14,000 tons having been produced in 1955, some 35% being consumed in the United States. In view of the extensive use of this vital metal, the accompanying chronology, compiled by Dr. Morral in the course of his researches, is published for the benefit of our readers. Dr. Morral has pointed out that a compilation such as this is not without flaws or omissions and that conflicting authorities, clashing data and many personal attitudes had to be harmonized.

2680-2530 BC

Egyptian statuettes of the 5th Dynasty colored with cobalt.

2250

Necklace found in Northwest Persia consisting of a number of glass beads colored blue with cobalt.

1480

Assyria sends "fine lapis of Babylon" to Egypt.

1450 to 1350 (?)

Babylonian and Egyptian pottery presumably from this era have been found colored with cobalt.

1200

Glass blued by cobalt found in ruins of Troy.

Xth Century

Solomon offered cobalt mines to Hiram of Tyre (page 214, Hoover's translation of De Re Metallica).

About 800

Egyptian pottery colored with cobalt—22nd Dynasty.

100

Date of making the Portland vase of blue and white carved glass.

79 A.D.

Pompeii destroyed. Cobalt-blue glass found in ruins.

76 to 138

Hadrian's reign in Rome. Glasses blued with cobalt.

618 to 906

Tang Dynasty in China. Cobalt coloring used in this era.

1368 to 1644

The use of cobalt colors greatly developed in the Ming Dynasty.

1443

Venetian glasses of this time have been found colored with cobalt.

1470

Start working silver-cobalt deposits at Schneeberg, Saxony.

1474

176 producing mines at Schneeberg.

1492

Cobalt deposits discovered in Annberg region of Saxony.

1496

Six mines paying dividends at Annberg.

1520

Peter Weidenhammer, of Schneeberg, prepared a blue color starting from the ores in The Erzgebirge, Saxony, Bohemia. The product from silver, cobalt, nickel, and bismuth arsenate was called "saffre." Weidenhammer sent this to Venice where it was used mainly to color glass beads blue.

1520

"Smalt" containing some 6 per cent cobalt sold to Venice at approximately $0.16 per pound (25 thalers a hundredweight—112 pounds).

1530

Bermamus by Agricola (see Hoover Translation of Agricola's De Re Metallica, London, 1912, pages 112 to 113) describes the production of "zaffre" or cobalt blue.

1540

V. Biringuccio in his Pirotechnia mentions "zaffre," used to form an azure blue for staining glass and pottery glaze.

1540

Christian Schürrer of Neudeck, in Bohemia, produced the double silicate of cobalt and potassium which, after granulation in water, results in "smalt." This has been used since in ceramics and glass. Schürrer then helped the Dutch build eight color works.

1548

Roasted cobalt ore was used for decorating pottery.

1556

G. Agricola in De Re Metallica lists several cobalt minerals and methods of treatment used at that time. (See Hoover's translation, 1912.)

1562

Johann Mathesius in a series of sermons (Nuremberg, 1562) suggested the possible derivation of the word cobalt from land of Cabul in Palestine.

1568

Christopher Stahl set up a small smelting works at Schneeberg and made blue pigment for artists. This plant was swept away by flood in 1573.

1575

Hans Harrer and Hans Jenitz requested a 10-year monopoly on cobalt pigment production and sale at Schneeberg. This was granted by the Prince.

16th-Century Terms

"Kobold"—a mischievous spirit associated with cobalt-bearing ores found in Harz Mountains (Saxony, Germany). Kobold, Kobalt, Kobelt, Kobolt, Cobel, Cobelt, Cobalt etc., appear in mining and metallurgical literature.

1603

The prince of Saxony put a tax on Dutch merchants and ordered strict supervision of export.

1609

Difficulties of cobalt industry in Saxony resulted in a royal decree by which all the cobalt made at Schneeberg was bought by the Prince. The buying and selling was to be handled by the tithe collector.

1651

Basil Valentine included cobalt in his list of metallic ores.

1651

Cobalt-ore deposits of Burma worked by Yunan Chinese until 1901 when the deposits were taken over by Europeans.

1651

The owner of the Blue Color Works of Oberschlema dies, and leaves the business to the Prince Elector of Saxony, Christian George II. This is the beginning of state ownership and influence on cobalt business.

1679

Directions for preparation of two materials—"zaffre" and "smalt"—given by J. von Kunkel. "Zaffre" is made by heating roasted mineral mixed with sand and "smalt" by fusing the mineral with sand.

Latter part of 17th Century

Invisible inks prepared from cobalt salts attracted considerable attention.

1705

D. J. Walchin recommended a solution of cobalt bismuthate for invisible inks (or "sympathetic" inks) that gave a green color on heating.

1735

Brandt, of Sweden, showed that color in blue glass called "smalt" arose from "cobalt rex." He prepared a very impure cobalt metal by separating it from bismuth. Brandt was the first to describe the properties of the metal.

1767

Silver-cobalt-nickel ores discovered at Chalanches, Dauphiné, France.

1773

According to J. G. Krünitz, miners applied term "Kobalt" to earth which colored glass blue.

1780

T. Bergman studied properties of cobalt salts.

1787

Bergman describes chemical properties of cobalt, and distinguishes this metal from nickel.

1790

Some 25 works engaged in cobalt industry in Saxony. Output possibly 300 tons of cobalt.

1792

F. Kapff, in his book Beytrage zur Geschichte des Kobolts, Koboltbergbaues u der Blaufarbenwerke, described methods of metal separation, magnetic properties of cobalt, and other characteristics. He estimated that 2500 tons of cobalt oxide were produced by 16 of the 23 works operating at the time.

1799

B. M. Tassaert studied the colored solution obtained as ammonium ion was added to aqueous solution of cobalt salt.

Early 19th Century

World supply of cobalt (as smalt and zaffre) was produced mainly in Norway, Sweden, and Saxony.

1802

Thénard studied the chemistry of cobalt compounds.

1806

J. L. Proust in his investigations tried to clear up some of the mystery involving cobalt.

1840

Charles Askin developed method of producing pure cobalt oxide. He was also one of the founders of Henry Wiggin & Co., Ltd., today a subsidiary of The Mond Nickel Co., Ltd. in England.

1850

E. V. Wright of Ottawa picked some stones near Temiskaming Lake (Ontario) while cutting forests. He waited 20 years to have his stones analyzed, and found them to be a silver galena containing cobalt.

1856

The Tschopenthal and Blaufarbenwerke, who had a monopoly on blue colorants for glass and ceramic industries, purchased the cobalt factory at Modum, South Norway.

1864

Garnier discovered cobalt deposits in New Caledonia.

1874

New Caledonia mines operating. They became the world's main source of cobalt in 1904.

1875

The Kruis River Mine in British South Africa was in operation under the direction of a German, Carl Maunch.

1876

Duisburg Küpferhütte formed. This company was to become the largest producer of cobalt from pyrites. This operation started in 1927 using an electrothermal refining process.

1879

Fleitmann discovered that magnesium additions make cobalt malleable.

1885

Illinski and von Knorre found that an organic reagent (1-nitroso-2-naphthol) could be used for the detection of cobalt.

1889

Cobalt plating described by A Watt in his book "Electrodeposition."

1891

Hubert Claus of Thale is said to have obtained a patent on adhering oxides for enamel coatings.

1892

S. P. Thompson finds that articles plated with cobalt are less corroded in the atmosphere of London than are articles plated with either silver or nickel. (Journal Institute Electrical Engineers, 1892, page 561.)

1893

Cobalt ores were discovered in Blackbird district of Idaho.

1896

World output of cobalt-ore products was over 500 tons.

1897

Sabatier and Sanderers, in France, suggested first use of cobalt as catalyst.

1897

A "Kobaltring" was formed by important producers for the purpose of keeping out new producers.

1898

World production of cobalt some 456 tons.

1900

Introduce use of cobalt as a drier in paints and varnishes.

1901

13,360 pounds of cobalt derived from slag produced in the smelting of lead ores at Mine La Motte, Missouri. Later, a refinery was operated at Fredericktown, Missouri.

1902

Methane synthesized over cobalt catalyst by Sabatier.

1903

F. LaRosa, foreman on railroad, while working near Temiskaming, set aside some ore samples of erythrite (cobalt arsenate). The Canadian geologist, W. G. Miller, described the deposits in the 1904 Annual Report of the Ontario Bureau of Mines.

1903

World production of cobalt some 550 tons.

1904

Cobalt, Ontario, produced 16 tons. The name Cobalt had been suggested in June by the geologist W. G. Miller.

1904

New Caledonia supplied 80 per cent of world cobalt ore, some 450 tons.

1906

October 30, Union Miniere du Haut Katanga, Ltd., formed and registered in Belgian Congo. Since 1940, largest producer of cobalt in world. Capitalization, 10 million Belgian francs.

1907

U. S. Patent 873,745 granted to E. Haynes on cobalt (90-40 per cent)—chromium (10-60 per cent) alloys. It was claimed that these alloys, named Stellites, were corrosion resistant, usable as metalworking tools, and usable as substitutes for platinum. See also Transactions AIME, Vol. 44, 1913, page 573.

1908

Cobalt tetracarbonyl was finally made after much research and many failures.

1908

Cobalt, Ontario, reached a maximum production of 542 tons. The cobalt production dropped to 0 in 1911 because of the interest in silver. (A second peak of 550 tons was reached in 1931.) Canada's output of cobalt was largest in its history, 1533 tons.

1908

Patent granted for a cobalt-phosphorus alloy to solder the wire leads to the filament wires of electric lamps.

1909

Tammann suggests a Co(80-67)-Cr (20-33), iron or nickel up to 25 per cent of cobalt-chromium alloy for steam and gas turbines. This alloy was claimed to be hard at 800 C.

1910

P. Weiss discovers that one of cobalt ferrites has magnetic properties better than those of pure iron.

1910

Smelter at Deloro, Ontario, refurnished with new equipment in 1907, commenced to produce mixed nickel-cobalt oxide. This smelter was previously an arsenic refinery operated by Canadian Gold-Fields. A new plant was later erected, which, in 1940, commenced production of cobalt from residue from Northern Rhodesia copper ores.

1910

Iron Trade Review August 4, and Journal of Industrial and Engineering Chemistry, October, 1910, page 397, announced the alloy which was the forerunner of what are now known as Stellites.

1910

Becker Steel Company of Krefeld, Germany, first showed that an addition of 5 per cent cobalt to a high-speed steel containing 18 per cent tungsten, 6 per cent chromium greatly improved tool performance. (German Patent 281,386, 1912.)

1911

A chromium-cobalt alloy was patented as a lamp filament.

1911

Cobalt oxide consumption was distributed as follows: Germany, 100 tons; France, 85 tons; America, 60 tons; and England, 45 tons, a total of 290 metric tons.

1912

R. O. Landrum writes on "Necessity of Cobalt Oxide in Ground Coat Enamels for Sheet Steel" in the Transactions of the American Ceramic Society.

1912

E. Haynes describes his work in cobalt-chromium alloys in Trans. AIME.

1913

Schlesinger made a systematic study of the effect of 5 per cent cobalt in high-speed steel.

1913

O. P. Watts presented paper on electroplating with cobalt. Transactions Electrochemical Society, 23, 1913, page 99 to 152.

1913

E. Haynes granted U. S. Patents 1,057,423 and later 1,057,828 on cobalt-chromium-tungsten alloys, also named Stellites, to be used for high-speed cutting.

1913

"By far the largest consumers of cobalt are the potteries." Ontario Bureau of Mines Annual Report.

1914

Cobalt-containing copper-ore deposits were discovered at Katanga, Belgian Congo.

1915

The Haynes Stellite Company purchased properties in the Blackbird, Idaho, district, because of E. Haynes' interest in cobalt. Between 1917 and 1920, some 4,000 tons of material were mined and milled.

1916

World cobalt output: 400 tons of cobalt oxide, and 154 tons of metal. H. T. Kalmus, of the Canadian Department of Mines, Ottawa, published his studies on "Physical Properties of Metallic Cobalt."

1916

A silver(10-20)-cobalt alloy was patented. It was claimed to be hard, tough, silver white, and not blackened by the action of sulphur-containing fumes.

1917

Heraeus of Germany patented a chromium-nickel-cobalt alloy for thermoelements.

1917

Stellites first used commercially. They became an important factor in munitions production in World War I, and were used for high-temperature and wear applications in World War II.

1917

K. Honda announced his cobalt-containing magnet steel.

1918

C. W. Drury published "Cobalt, Its Occurrence, Metallurgy Use and Alloys," Ontario, Department of Mines Report, Canada, Vol. 27, 1918, Part III.

1919

A. W. Hull and W. P. Davey announce that X-ray diffraction studies showed that cobalt was allotropic — hexagonal and face-centered cubic.

1919

Deloro Smelting and Refining Company also entered the field of manufacture of Stellites for Canada and England.

1919

Driver-Harris patented a 50 per cent magnesium—50 per cent cobalt alloy to be used for deoxidation of cobalt alloys.

1919

A cobalt-base alloy (10 aluminum, 30 to 40 copper-cobalt alloy), Sunbronce, was suggested for jewelry (also a 25 aluminum, 30 copper, 10 iron, 35 cobalt alloy).

1920

Union Miniere du Haut Katanga began extraction of cobalt from their cobalt-copper ores from Katanga, Belgian Congo.

1920

Dr. C. G. Fink of Columbia University developed cobalt-base insoluble anodes for sulfate solutions. They were particularly resistant to chlorine and nitrate ions.

1920

Annual cobalt oxide consumption in U. S. approximately 120 tons in ceramic, metallurgical, drier, and other industries.

1921

35 per cent cobalt steel was found to be an excellent permanent magnet. Price of cobalt at its highest, $5.10 per pound.

1921

M. H. Carson applied ammoniacal leaching to various cobalt and nickel ores and applied for Dutch and South African patents. (Transactions, American Institute of Mining and Metallurgical Engineers, Vol. 64, 1954-5, pages 611-616.)

1923

German patent granted to K. Schroter (420,689) on the use of cobalt to bind tungsten and carbon. This was exploited by Krupp under the trade name "Wydia" in 1927.

1923

0.1 to 0.5 per cent cobalt added to aluminum-silicon (5 to 15 per cent) alloys was found to improve physical properties, refine grain, and eliminate iron nuisance effect.

1923

A matrix for diamond tools, consisting of a 30 per cent cobalt, 30 per cent copper, and 40 per cent molybdenum alloy, was suggested.

1925

Fischer and Tropsch of the Kaiser Wilhelm Institute developed the strong catalytic properties of cobalt for the synthesis of liquid hydrocarbons.

1926

Cobalt used in electric-heating element by Kanthal, a Swedish concern.

1926

Western Electric finds that nickel-cobalt-iron alloys may make alloys of constant permeability in a given field, with little or no hysteresis.

1927

Formation and fractionation of volatile cobalt carbonyl was suggested by Müller and co-workers (German Patent 483,603).

1927

Carboloy in U. S. started producing sintered tungsten-carbide bonded with cobalt. These were to find use in dies, cutting tools, wear-resistance applications in mining, wire dies, etc.

1927

Addition of beryllium (up to 15 per cent) to cobalt found to produce heat-treatable alloys suitable for springs and wear-resistant applications.

1928

Diamond steel was the name given to a 45 cobalt—15 chromium—40 molybdenum alloy.

1928

Erythrite was found in the region of Bou Azzer, near the Atlas Mountains, Africa.

1930

Cobalt found in great copper deposits of Northern Rhodesia.

1930

World production of cobalt is a total of over 1,000 metric tons.

1931

Köster developed cobalt-chromium-molybdenum for magnets.

1932

Cobalt produced from nickel-gold-silver-cobalt ores found in French Morocco.

1932

E. C. Bain finds that cobalt reduces the hardenability of steels, as opposed to the fact that most elements soluble in iron (fcc) increase hardenability.

1933

H. Osborg suggests a lithium-cobalt alloy to scavenge and purify molten gold, iron, or nickel and their alloys.

1933

February report on Northern Rhodesian minerals mentions cobalt for the first time for this region.

1933

Rhokana Corporation granted several French patents on methods to obtain electrolytic cobalt.

1934

Association of German cobalt producers formed. It consisted of two metal producers and ten producers of cobalt oxide and salts.

1934

Filmer and Underwood showed that cobalt was the curative agent present in the impure iron salts which had been successfully used to treat deficiency diseases in sheep.

1934

Cobalt anodes are suggested for the mordanting of fabrics by electrolysis. Cobalt also suggested for tanning leather.

1934

Japan Cobalt Co. succeeded in producing cobalt and cobalt oxide in Japan after several years of experimentation.

1934

K. Honda announced a permanent-magnet steel composed of iron-nickel-cobalt-titanium, known as "new K-S."

1934

World production of cobalt goes over 2,000 short tons.

1935

Alnico series of permanent magnets (iron-nickel-cobalt-aluminum) developed simultaneously by General Electric and Prof. Mishima of Japan.

1935

H. Scott developed iron-28 nickel-18 cobalt alloy for metal-glass seals.

1935

Trade pact between Association of German Cobalt Producers and Cobalt Association. Since 1930, Rhokana Corporation, Ltd., and La Societe Miniere de Bou Azzer et du Graara had joined the Cobalt Association.

1936

Dental alloy Vitallium developed. Later, at the beginning of World War II, because of high-temperature properties, it was used in buckets for turbocompressors of aircraft engines (65 cobalt—30 chomium—5 molybdenum).

1936

Alnico industrial production announced by General Electric.

1936

It was found that small amounts of cobalt and other salts added to electrolyte resulted in bright nickel coatings. These were used as undercoatings for chromium.

1936

Ninety per cent of world cobalt output represented in Cobalt Association when

Osa-keyhtio Vuaksenniska A.B. of Finland joined.

1936

Jellinghaus announced cobalt-platinum permanent-magnet alloys.

1936

The effect of cobalt deficiency in soil on cattle nutrition realized in New Zealand by Askew and others.

1937

Burma produced over 300 tons of cobalt, the largest amount in its history.

1937

Use of cobalt in bright plating appears to increase.

1937

Cobalt isotopes Co^{55}, Co^{56}, Co^{58}, and Co^{60} observed and produced artificially.

1937

W. P. Sykes of General Electric publishes his paper on iron-cobalt-tungsten alloys (50-30-20) developed at Cleveland Wire Works of General Electric.

1938

Catalytic characteristics of cobalt recognized for organic and petroleum chemistry.

1938

Cobalt production in French Morocco reaches a peak of 800 tons, and world production nears 5,000 short tons.

1938

Experiments made to recover cobalt from pyrite mined at Cornwall, Pennsylvania.

1938

Finns erect cobalt smelter at Imatra.

1939

Russian cobalt production has been estimated at 560 short tons this year.

1939

Northern Rhodesia produced largest amount of cobalt in its history, some 1,750 tons.

1939

World production of cobalt ores 4,500 short tons.

1940

Vicalloy (iron-cobalt-vanadium) permanent magnet developed by G. A. Kellsall and E. A. Nesbitt.

1940

International Nickel Company commences recovery of cobalt at its nickel refinery at Clydach, Wales, England.

1940

Metals Reserves Company of U. S. advises that they would purchase 7,000 tons of cobalt concentrate. (More than 3,000 tons were delivered between April 1, 1940, and February 22, 1942.)

1940

Bethlehem Steel Company started to produce cobalt from pyrites.

1940

A U. S. Bureau of Mines experiment station started work on electrowinning of cobalt from U. S. ores.

1940

Chemical Construction Company started work on chemical methods of winning metals.

1940

World production of cobalt reaches 5,000 metric tons.

1940

Union Carbide and Carbon Company started operating African Metal Co. plant at Niagara Falls.

1941

Discovered preferred magnetic orientation gave improved characteristic in iron-nickel-cobalt-aluminum alloys (Alnico).

1943

Cobalt oxide produced at new plant of Ferro Enamel Supply Co., of Cleveland, Ohio.

1943

Calera Mining Company, subsidiary of Howe Sound, became interested in Blackbird, Idaho, cobalt-bearing district.

1944

St. Louis Smelting and Refining Company began production at Fredericktown, Missouri.

1945

Union Minière du Haut Katanga started operating electrolytic plant in Belgian Congo, producing 120 to 150 tons per month of cobalt.

1945

General Electric announced development of iron oxide-cobalt-oxide-type magnets.

1946

R. Perrault wrote Le Cobalt, Paris, Dunods.

1947

"J" alloy proposed for jet engines by Grant of MIT. Alloy based on Vitallium, a chromium-cobalt-molybdenum alloy developed in 1936. Elgiloy, alloy developed at Battele Memorial Institute, used in manufacture of long-lived watch springs (cobalt-copper-nickel-iron-molybdenum).

1948

Iron-nickel-cobalt-aluminum alloys announced with crystalline and magnetic preferred orientations.

1948

Porcelain enamel industry in U. S. using in excess of 200 tons of cobalt oxide per year.

1948

Cobalt, ACS Monograph, published by Reinhold; author, R. S. Young, Chief Metallurgist of Rhokana.

1948

Sintered Alnico V used in relays, meters, fountain pens (to hold cap), electronic reproducers, and compasses.

1948

Cobalt-60 equivalent to 2 million-volt X-ray machine used for radiography and to gage cupola-metal height, according to D. McCutcheon of Ford Motor Company.

1949

Sherrit Gordon Mining Company, Limited, first plant to establish pilot-plant work by using Chemical Construction Company's method of recovery of cobalt from lean ores.

1949

Alnico's magnet developments include Alnico 7 for motors, generators, and air gages, and Alnico 5DG for loudspeakers, and magnetic assemblies. Alnico also used as clamps for the ground cable on electric welders.

1949

An 80 per cent cobalt alloy is patented (U. S. 2,469,715) Octanium (cobalt and seven other metals) used as points for fountain pens.

1949

G. T. Trapp suggests a method of recovering cobalt from hard-metal carbides. (U. S. 2,485,175.)

1950

April—Cobalt smelter of Cobalt Chemical and Refining Company of Canada, reached production stage and was destroyed by fire.

1950

World production of cobalt is over 7,200 metric tons.

1951

U. S. Patent 2,574,626, uranium-cobalt intermetallic compound (UCo_2). Compound is claimed to have corrosion resistance far superior to that of uranium.

1951

March 12 — Manganese - nickel - cobalt Committee of International Materials Conference met. An allocation plan was adopted for the fourth quarter of 1951.

1951

Radioactivity of cobalt used for analyzing cobalt in alloys. Alloy was irradiated in a flux of neutrons. 0.5 mg. of cobalt detected.

1952

The supply-and-demand situation improved in 1952, and no allocations were made at the end of the fourth quarter of 1952.

1952

July—Falconbridge Nickel Mine, Ltd., began production of electrolytic cobalt at its refinery at Kristiansand, Norway. The nickel-cobalt matte is produced at its Falconbridge, Ontario, smelter. Annual production is 200 tons of cobalt.

1952

A method of recovery of cobalt from Alnico-type scrap described by A. H. Sherman and M. Preser in Iron Age, Vol. 170 (1), July 3, 1952, pages 115 to 119.

1952

G. T. Harris of Wm. Jessop and Son, England, developed G32 for turbine blades.

1952

Rhokana Corporation, Ltd., started producing electrolytic cobalt at its Nkana plant in Northern Rhodesia.

1952

Chemical Construction Company, subsidiary of American Cyanamid, completed building recovery plant for Calera Mining Company, subsidiary of Howe Sound (capacity 1,650 tons/yr.). Ores of Blackbird district used after concentration. The new process uses leaching under pressure and controlled precipitation of metals. Useful method for low-grade ores and residues.

1953

Haynes Alloy No. 99 developed to use high-temperature-alloy scrap.

1954

Cobalt in Canada, by R. J. Jones, Department of Mines and Technical Survey, Ottawa, Mines Branch, No. 847.

1954

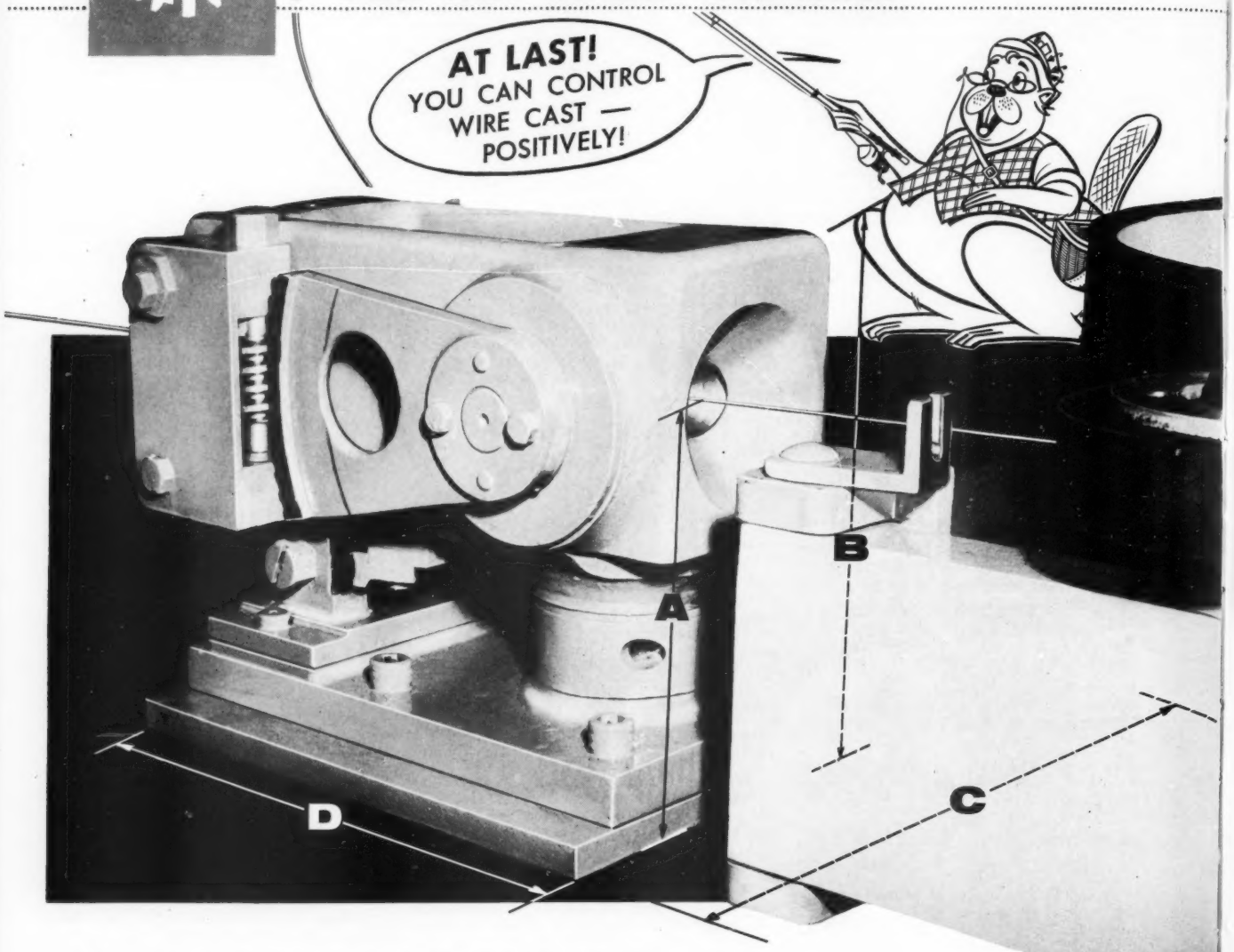
October — International Nickel Company commenced production of electrolytic cobalt at Port Colbourne, Canada.

1954

Russian cobalt production has been

(*Please turn to page* 334)

ADJUSTABLE DRAW-CAST DIE BOX
FOR WET OR DRY DRAWING



The new Coulter & McKenzie ADJUSTABLE DRAW-CAST DIE BOX with true center-line pivotal action takes *all* the guesswork out of wire casting! You can *quickly* and *positively* establish the desired loop diameter and pitch of your wire with just 2 simple adjustments.

LOOK AT THESE ADVANTAGES:

1. Positive Adjustable Control of cast and pitch.
2. Completely eliminates or greatly reduces skilled use of casting rolls.
3. Positive locking of controls and die insures uniform constant cast, coil after coil.
4. Graduated indication permits keeping records for quality control and duplication when changing sizes or analysis.
5. Easy to install on most types of wire drawing equipment.

MODEL NO.	MAX. DIE SIZE CASING O.D.	NET WEIGHT	DIMENSIONS			
			A	B	C	D
1	1"	8 lbs.	2⅝"	4"	6"	4½"
2	1½"	14 lbs.	2⅞"	4½"	6½"	5"
3	2"	125 lbs.	7¼"	10½"	9½"	12½"

Model No. 3 (Illustrated) may be arranged for direct water cooling of die casing.

U.S. and foreign patents applied for.

Patent No. 2,732,060—other U. S. and foreign patents pending.

771 WATER STREET
OPPOSITE RAILROAD STATION

TELEPHONE EDISON 5-1101
LIEBER'S CODE "MACKENZIE"

THE COULTER & McKENZIE MACHINE CO., INC.

The Geometry of Isodiametric, Multiconductor Cable

by Sam Kalifon, B.Ch.E.
Product Engineer
Hatfield Wire & Cable Division
Continental Copper and Steel Industries, Inc.
Hillside, New Jersey

The Geometry of the Isodiametric, Multiconductor Cable

The mathematical study of this material is best undertaken in the form of a series of geometrical propositions. The analytical conclusions of these propositions can then be used as a basis for the manufacture of this cable. The propositions follow forthwith:

Proposition #1

The number of round, incompressible cylinders of diameter d that can be laid parallel about a round cylindrical core of diameter D is given by the expression

$$n = 180/\arcsin\frac{1}{K+1}$$

Where
- d = the diameter of each cylinder
- D = the diameter of the core underneath
- θ = the angle subtended by each cylinder
- n = the total number of circumscribing cylinders
- k = D/d

See Figure I

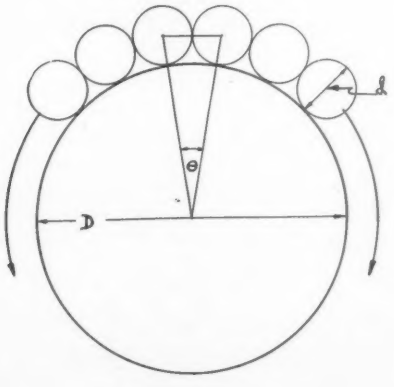


FIGURE 1

From the figure,

$$\frac{d}{(D+d)/2} = d/(D+d)$$
$$= \sin(\tfrac{1}{2})(360/n)$$
$$= \sin 180/n$$
$$\text{or, } n = 180 \arcsin\frac{d}{D+d}$$

However, expressing D as a multiple of d, i.e., D = kd,

$$n = 180/\arcsin\frac{1}{K+1}$$

Based on this formula, the values of d, D, and n are evaluated and tabulated in Table I.

In this article the author gives a condensation of his notes on the subject, from which he has omitted just those occasional observations and calculations that are useful only in their own shop.

Table I

n	arcsin 1/(K+1)	1/(K+1)	K=D/d	OD
3	60.00°	.8660	0.155	2.155d
4	45.00°	.7071	0.414	2.414d
5	36.00°	.5878	0.701	2.701d
6	30.00°	.5000	1.000	3.000d
7	25.71°	.4339	1.305	3.305d
8	22.50°	.3827	1.613	3.613d
9	20.00°	.3420	1.924	3.924d
10	18.00°	.3090	2.236	4.236d
11	16.36°	.2818	2.549	4.549d
12	15.00°	.2588	2.864	4.864d
13	13.85°	.2394	3.177	5.177d
14	12.86°	.2224	3.496	5.496d
15	12.00°	.2079	3.810	5.810d
16	11.25°	.1951	4.126	6.126d
17	10.59°	.1837	4.444	6.444d
18	10.00°	.1737	4.757	6.757d
19	9.47°	.1645	5.079	7.079d
20	9.00°	.1564	5.394	7.394d
21	8.57°	.1490	5.711	7.711d
22	8.18°	.1423	6.027	8.027d
23	7.83°	.1363	6.337	8.337d
24	7.50°	.1305	6.663	8.663d
25	7.20°	.1253	6.981	8.981d
26	6.92°	.1204	7.306	9.306d
27	6.67°	.1161	7.613	9.613d
28	6.43°	.1121	7.925	9.925d
29	6.21°	.1080	8.259	10.26 d
30	6.00°	.1045	8.567	10.57 d
31	5.81°	.1011	8.895	10.90 d
32	5.63°	09816	9.198	11.20 d
33	5.46°	09498	9.529	11.53 d
34	5.29°	09237	9.826	11.83 d
35	5.14°	08976	10.14	12.14 d
36	5.00°	08715	10.47	12.47 d
37	4.87°	08484	10.79	12.79 d

Proposition #2

The diameter of the pliable, cylindrical fillers and the number of such fillers needed to fill a cylindrical annulus is given by the following expression:

$$j = \sqrt{.318D^2 - .0693d'^2} - d'/2$$
$$n = \pi(d'+j)/j$$

Where
- A = the area of the annular region between a round core and the inner surface of the next layer of conductors
- D = the outer diameter of the annulus over which the next layer of conductors is applied
- d' = the inner diameter of the annulus representing the diameter of the core underneath
- j = the theoretical diameter of one filler which deforms and helps to exactly fill the annular region
- n = the number of ends of filler required

See Figure II

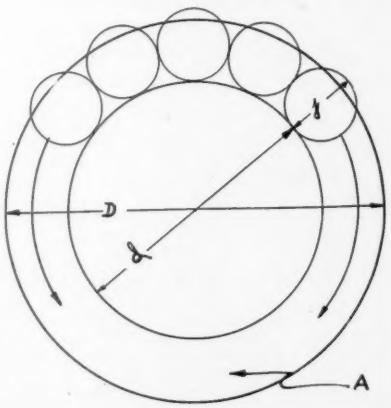


FIGURE 2

Notes on Table 1

(1) **The listing can be continued indefinitely, of course, but the likelihood of needing values in such extreme cases is almost nil.**

(2) **The OD values shown under the last boxhead apply to a single layer of conductors over a core of diameter D, so that the diameter of such an assembly is D+2d.**

From figure II, the area to be filled with jute is

$$A = \frac{\pi}{4}(D^2 - d'^2)$$

Let j = the required jute diam.
and n = the necessary number of jute ends

Then $A = \pi n j^2/4$

$$n\pi j^2/4 = \frac{\pi}{4}(D^2 - d'^2)$$

$$nj^2 = D^2 - d'^2$$

$$j^2 = (D^2 - d'^2)/n \quad (1)$$

$$j = \sqrt{(D^2 - d'^2)/n}$$

However, the n ends of jute are presumed to lie evenly around the inner core prior to compression by the superimposed layer of conductors.

Hence, $n = (d' + j)\pi/j \quad (2)$

Substituting equation (2) into (1),

$$j^2 = \frac{(D^2 - d'^2)}{\pi(d' + j)} \cdot j$$

$$j = \frac{D^2 - d'^2}{\pi(d' + j)}$$

$$j^2 + d'j = (D^2 - d'^2)/\pi$$

$$j^2 + d'j + d'^2/4 = (D^2 - d'^2)/\pi + d'^2/4$$

$$(j + d'/2)^2 = \frac{(D^2 - d'^2)}{\pi} + d'^2/4$$

$$j + d'/2 = \sqrt{(D^2 - d'^2)/\pi + d'^2/4}$$

$$j = \sqrt{(D^2 - d'^2)/\pi + d'^2/4} - d'/2$$

or, $j = \sqrt{.318D^2 - .0683d'^2} - d'/2$

Based on these formulas, the values of n and j most likely to occur in cables containing up to 37 individual conductors are evaluated and tabulated in table II.

TABLE II

Total Conductors	Make-up	D	d'	.06831d'²	.3183D²	j	n
8	1- j7	1.305d	d	.06831d²	.5121d²	.1883d	19.8
9	1 - j8	1.613d	d	.06831d²	.8282d²	.3717d	11.6
10	1 - j9	1.92hd	d	.06831d²	1.178d²	.5536d	8.8
13	3 - j10	2.236d	2.155d	.3172d²	1.592d²	.0512d	135
15	4 - j11	2.549d	2.41hd	.3981d²	2.068d²	.0853d	92.0
17	5 - j12	2.86hd	2.701d	.4983d²	2.611d²	.1027d	85.8
20	1 - 6 - j13	3.177d	3.000d	.6418d²	3.213d²	.1118d	87.4
22	1 -j7 - j14	3.496d	3.305d	.7462d²	3.890d²	.1206d	89.2
24	1 -j8 - j15	3.810d	3.613d	.8917d²	4.620d²	.1246d	94.2
27	2 - 9 - j16	4.126d	4.000d	1.093d²	5.419d²	.0729d	160
31	4 -10 - j17	4.hhhd	4.hhhd	1.330d²	6.286d²	.0190d	733

Notes

(1) The values of n under the last boxhead are theoretically determined and are therefor shown exactly. In the practical case, the actual number of ends and the size of jute to be used is determined by rounding out the listed values of n to the nearest integer and then modifying the calculated value of j in the contrary direction to give the correct poundage of jute needed.

★ ★ ★

For example:

Suppose the values of n and j for a nine conductor control cable were needed, where each insulated conductor consisted of a #12 solid copper insulated with a 2/64" wall to a nominal OD of .145". The value of j would be (.3717) (.145) =.0539. By the jute graphs provided here, .0539 is found to correspond to a jute size of 26.73. Accordingly, the product of 26.73 and n=11.6 is 310.0. This product is interpreted to mean that 310 pounds of jute will be needed for bedding purposes. If the strands of jute are laid on parallel to the axis of the cable, then the size needed will be 310/12.0 =26.7, i.e., 27. If on the other hand, the jute strands are applied spirally, fewer ends will be needed and the value of n for this case becomes 11.6/Secθ, where θ is the angle between the line of jute application and the axis of the cable. In either event, however, the weight of jute remains the same.

★ ★ ★

(2) It is at once obvious that the use of such an extraordinarily large number of ends of jute as 733 is highly impractical. Actually, the implication is that the annular area might best be left unfilled since the clearance is small. For intermediate values of n, such as 135, fillage is more easily effected with a wrap of heavy yarn, applied with a braiding machine. The value of j is here determined as before, but instead of consulting the jute graphs, the proper size of yarn is selected from the table of DIAMETERS OF COTTON YARN. The procedure is identical in principle in either case.

Proposition #3

The cross-sectional area that lies under a layer of n conductors and which must be filled with a mass of jute to prevent structural collapse is given by the expression

$$A_j = (d^2/4)\left[n\cot(180/n) - \pi(n-2)/2\right]$$

Where
A_j = the cross-sectional area in question
d = the diameter of one conductor
n = the total number of conductors in the layer.

See Figure III

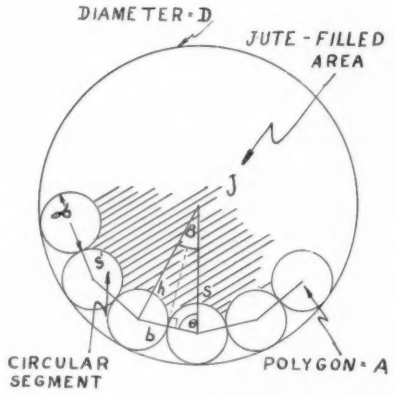


FIGURE 3

Area of Polygon A

$S = (D-d)/2$

$h/S = \sin\theta$, $h = S\sin\theta = (D-d)\sin\theta/2$

$b/2S = \cos\theta = b/(D-d)$

$b = (D-d)\cos\theta$

Area of Triangle

$$bh/2 = (D-d)\cos\theta\cdot(D-d)\sin\theta/4$$
$$= (D-d)^2\sin 2\theta/8$$
$$= (D-d)^2\sin\frac{180(n-2)}{n}/8$$

Area of Polygon, i.e., n Triangles

$$A_p = \frac{n}{8}(D-d)^2\sin\frac{180(n-2)}{n}$$

Area of Circular Segment

$$\frac{\pi d^2}{4}\cdot\frac{2\theta}{360} = \frac{\pi d^2}{4}\cdot\frac{\theta}{180}$$

Areas of All Circular Segments

$$A_s = \frac{\pi d^2}{4}\cdot\frac{n\theta}{180}$$

The Value of the jute-filled area, A_j, must equal the difference between the area of the polygon and the area of all the circular segments, i.e.,

$$A_j = A_p - A_s$$

$$A_j = \frac{n}{8}(D-d)^2\sin\frac{180(n-2)}{n} - \frac{\pi d^2}{4}\cdot\frac{n\theta}{180}$$

But,

$$\theta = n - 2\cdot\frac{180}{2n}$$

Whence,

$$A_j = \frac{n}{8}(D-d)^2\sin\frac{180(n-2)}{n} - \frac{\pi d^2}{8}(n-2)$$

Now,

$$D = d\left[\frac{1}{\sin 180/n} + 1\right]$$

Hence,

$$A_j = \frac{n}{8}\left[\frac{d}{\sin 180/n} + d - d\right]^2 \cdot \sin 180\left(\frac{n-2}{n}\right) - \frac{\pi d^2}{8}(n-2)$$

$$= \frac{n}{8}\left[\frac{d}{\sin 180/n}\right]^2 \sin 180\left(\frac{n-2}{2}\right) - \frac{\pi d^2}{8}(n-2)$$

But,

$$\sin 180\frac{(n-2)}{n} = \sin 180(1-2/n) = \sin(180 - 360/n)$$

$$= \sin 180 \cos 360/n - \cos 180 \sin 360/n$$

$$= \sin 360 n$$

Then,

$$A_j = \frac{n}{8} \cdot \frac{d^2}{\sin^2 \frac{180}{n}} \cdot \frac{\sin 2(180/n)}{\sin (180/n)} - \frac{\pi d^2}{8}(n-2)$$

$$= \frac{n}{8} \cdot \frac{d^2}{\sin 180/n} \cdot \frac{2 \sin 180/n \cos 180/n}{\sin 180/n} - \frac{\pi d^2}{8}(n-2)$$

$$= \frac{n}{8} \cdot \frac{d^2}{\sin 180/n} \cdot 2 \cos 180/n - \frac{\pi d^2}{8}(n-2)$$

$$= \frac{n d^2}{4} \cot 180/n - \frac{\pi d^2}{8}(n-2)$$

Or,

$$A_j = \frac{d^2}{4}\left[n \cot \frac{180}{n} - \frac{\pi}{2}(n-2)\right]$$

In order to eliminate an excessive number of rather involved arithmetical calculations, the diameter of a single end of jute that will exactly fill the hollow is derived below. In practice, of course, the use of a single end of jute would be the exception rather than the rule. However, the fictive diameter derived here is easily transliterated into terms of multiple end jute.

$$A_j = \frac{d^2}{4}\left[n \cot 180/n - \frac{\pi}{2}(n-2)\right]$$

$$= d^2 A'_j$$

Where A_j may be considered to be a fictitious circle having a diameter Θ, so that

Whence,

$$\frac{\pi}{4}\phi^2 = d^2 A'_j$$

whence,

$$\phi = d\sqrt{A'_j \frac{\pi}{\pi}}$$

$$= 1.1295 d \sqrt{A'_j}$$

Ø, **then,** represents the diameter of a filler which if sufficiently pliable and incompressible in behavior will just fill the hollow core under a layer of conductors. For any real material selected as a filler, a compressibility factor must be experimentally determined. For jute, this factor, for this specific application appears to be 1.15. Having determined the fictive diameter for some particular application, the size of jute can then be obtained from the expression

$$S = 9200\phi^2$$

or from the graphs relating the values of S and Ø appearing in this article.

★ ★ ★

The values of A'_j for successive values of n are given in table III.

Proposition #4

The cross-sectional area of a valley lying between 2 conductors and bounded at the open end by a tangential, circumscribed circle is given by the expression

$$A = \frac{d^2}{4n}\left[\pi\left(\frac{1}{\sin \frac{180}{n}} + 1\right)^2 - n \cot \frac{180}{n} - \frac{\pi}{2}(n-2)\right]$$

where A = the area under consideration
n = the number of conductors in the layer
and d = the diameter of one such conductor

See Figure 4

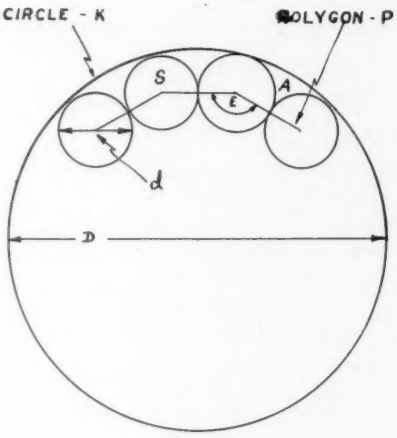


FIGURE 4

Evaluation of $A'_j = A/d^2$

Table III

n	180/n	Cot (180/n)	nCot (180/n)	(π/2)(n-2)	A'
3	60.00	.5774	1.7321	1.5708	.0403
4	45.00	1.0000	4.0000	3.1416	.2146
5	36.00	1.3764	6.8820	4.7124	.5124
6	30.00	1.7320	10.392	6.2832	1.027
7	25.71	2.0763	14.534	7.8540	1.670
8	22.50	2.4142	19.313	9.4248	2.472
9	20.00	2.7475	24.728	10.996	3.433
10	18.00	3.0777	30.777	12.566	4.553
11	16.36	3.4050	37.455	14.137	5.830
12	15.00	3.7320	44.784	15.708	7.269
13	13.85	4.0560	52.728	17.279	8.862
14	12.86	4.3779	61.291	18.850	10.610
15	12.00	4.7046	70.569	20.420	12.537
16	11.25	5.0273	80.437	21.991	14.612
17	10.59	5.3521	90.986	23.562	16.856
18	10.00	5.6713	102.08	25.133	19.237
19	9.47	5.9972	113.95	26.703	21.812
20	9.00	6.3137	126.27	28.274	24.249
21	8.57	6.6383	139.40	29.845	27.388
22	8.18	6.9538	152.98	31.416	30.391
23	7.83	7.2687	167.18	32.987	33.548
24	7.50	7.5957	182.30	34.558	36.936
25	7.20	7.9158	197.90	36.128	40.443
26	6.92	8.2434	214.33	37.699	44.158
27	6.67	8.5555	231.00	39.270	47.933
28	6.43	8.8686	248.32	40.841	51.870
29	6.21	9.1803	266.23	42.412	55.955
30	6.00	9.5144	285.43	43.982	60.355
31	5.81	9.8164	304.31	45.553	64.689
32	5.63	10.138	324.42	47.124	69.324
33	5.45	10.481	345.88	48.695	74.296
34	5.29	10.814	367.68	50.266	79.354
35	5.14	11.132	389.62	51.836	84.446
36	5.00	11.430	411.48	53.407	89.518
37	4.86	11.745	434.57	54.979	94.898
38	4.74	12.077	458.93	56.549	100.60
39	4.62	12.384	482.98	58.120	106.22
40	4.50	12.706	508.24	59.690	112.14

The figures in the last column, when multiplied by the square of the conductor diameter, will give the cross-sectional area that must be filled with juts.

$A = (A_H - A_P - A_S)n$

Area of Polygon P
$= A_P = \frac{n}{8}\cdot(D-d)^2 \cdot \sin\frac{180(n-2)}{n}$

Area of Circle K
$= \pi d^2/4$

Area of Sectors Σ_S
$= \frac{\pi d^2}{8}\cdot(n-2)$

For, $S = (\pi d^2/4)\cdot Q/360$

Where Q = Explement of Angle E

But $E = \frac{n-2}{n}\cdot 180°$

Whence $Q = 360 - \frac{n-2}{n}\cdot 180° = 180°\cdot\frac{n+2}{n}$

And $\Sigma_S = \frac{\pi d^2}{4}\cdot\frac{n+2}{n}\cdot\frac{n}{360}\cdot 180$
$= \frac{\pi d^2}{4}\cdot\frac{n+2}{n}$, or, $\frac{\pi d^2}{8}\cdot(n+2)$

$A = \frac{1}{n}\left[\frac{\pi d^2}{4}\left(\frac{1}{\sin\frac{180}{n}}+1\right)^2 - \frac{n}{8}\left(\frac{d}{\sin\frac{180}{n}}\right)^2\cdot\sin\frac{180(n-2)}{n} - \frac{\pi d^2}{8}(n+2)\right]$

$= \frac{d^2}{4n}\left[\pi\left(\frac{1}{\sin\frac{180}{n}}+1\right)^2 - \frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2\cdot\sin\frac{180(n-2)}{n} - \frac{\pi}{2}(n-2)\right]$

However,

$\frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2\left[\sin\frac{180(n-2)}{n} + \frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2\cdot\sin(180 - 360/n\right.$

$= \frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2\left[\sin 180\cos\frac{360}{n} - \cos 180\sin\frac{360}{n}\right]$

$= \frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2\cdot\sin\frac{360}{n}$

$= \frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2(\sin 2\cdot\frac{180}{n})$

$= \frac{n}{2}\left(\frac{1}{\sin\frac{180}{n}}\right)^2 2\sin\frac{180}{n}\cdot\cos\frac{180}{n}$

$= n\cdot\frac{\cos\frac{180}{n}}{\sin\frac{180}{n}}$

$= n\cot\frac{180}{n}$

And $A = \frac{d^2}{4n}\left[\pi\left(\frac{1}{\sin\frac{180}{n}}+1\right)^2 - n\cot\frac{180}{n} - \frac{\pi}{2}(n-2)\right]$

The values of A for successive values of n are evaluated in terms of d and tabulated in Table IVa.

★ ★ ★

As in the case of the core filler, determination of the actual size of jute needed to fill a valley can be simplified by the principle of the fictive diameter. Thus

$Kd^2 = \frac{\pi}{4}\cdot d_j^2$

where d_j = the fictive diam. of the filler

Then, $d_j^2 = 4Kd^2/\pi$

And, $d_j = d\sqrt{4K/\pi}$
$= 1.128\sqrt{K}\,d$

Here, too, a compressibility factor is involved and should be determined experimentally. Actual experience reveals that this factor for this application is less than 1.0 and turns out to be, in fact, 0.80.

★ ★ ★

The values of d_j, in terms of d, the conductor diameter, are evaluated and tabulated in table IV. The value of k appearing in this equation is that listed in table III under the last boxhead.

Conclusion

The mathematical foundation of this study is thus concluded, and there remains only the problem of establishing the linkage between this and the actual construction of the cable.

TABLE IVa

The Values of $d_j = 1.128d\sqrt{K}$

	Number of Conductors in Peripheral Layer													
	2	3	4	5	6	7	8	9	10	11-12	13-15	16-21	22-35	36-37
d	Value of d_j													
.051	.0512	.0373	.0321	.0288	.0270	.0257	.0251	.0244	.0237	.0230	.0223	.0215	.0208	.0199
.054	.0542	.0395	.0340	.0305	.0286	.0272	.0266	.0258	.0251	.0244	.0236	.0228	.0220	.0211
.057	.0572	.0417	.0359	.0322	.0302	.0287	.0280	.0272	.0265	.0257	.0249	.0241	.0232	.0222
.060	.0602	.0439	.0377	.0338	.0317	.0302	.0295	.0287	.0279	.0271	.0262	.0253	.0244	.0234
.063	.0632	.0461	.0396	.0355	.0333	.0318	.0310	.0301	.0293	.0284	.0275	.0266	.0256	.0246
.066	.0662	.0483	.0415	.0372	.0349	.0333	.0325	.0316	.0307	.0298	.0288	.0279	.0269	.0257
.069	.0692	.0504	.0434	.0339	.0365	.0348	.0340	.0330	.0321	.0311	.0302	.0291	.0281	.0269
.072	.0722	.0526	.0453	.0406	.0381	.0363	.0354	.0344	.0335	.0325	.0315	.0304	.0293	.0281
.075	.0752	.0548	.0472	.0423	.0397	.0378	.0369	.0359	.0349	.0338	.0328	.0316	.0305	.0293
.078	.0782	.0570	.0491	.0440	.0413	.0393	.0384	.0373	.0363	.0352	.0341	.0329	.0317	.0304
.081	.0812	.0592	.0510	.0457	.0429	.0408	.0399	.0387	.0377	.0365	.0354	.0342	.0330	.0316
.084	.0842	.0614	.0528	.0474	.0444	.0423	.0413	.0402	.0391	.0379	.0367	.0354	.0342	.0328
.087	.0872	.0636	.0547	.0491	.0460	.0439	.0428	.0416	.0405	.0392	.0380	.0367	.0354	.0339
.090	.0902	.0658	.0566	.0508	.0476	.0454	.0443	.0430	.0419	.0406	.0393	.0380	.0366	.0351
.093	.0933	.0680	.0585	.0525	.0492	.0469	.0458	.0445	.0433	.0419	.0406	.0392	.0379	.0363
.096	.0963	.0702	.0604	.0541	.0508	.0484	.0472	.0459	.0446	.0433	.0420	.0405	.0391	.0374
.099	.0993	.0724	.0623	.0558	.0524	.0499	.0487	.0473	.0460	.0446	.0433	.0418	.0403	.0386
.102	.1023	.0746	.0642	.0575	.0540	.0514	.0502	.0488	.0474	.0460	.0446	.0430	.0415	.0398
.105	.1053	.0768	.0660	.0592	.0556	.0529	.0517	.0502	.0488	.0474	.0459	.0443	.0427	.0410
.108	.1083	.0790	.0679	.0609	.0571	.0544	.0531	.0516	.0502	.0487	.0472	.0456	.0440	.0421
.111	.1113	.0811	.0698	.0626	.0587	.0559	.0546	.0531	.0516	.0501	.0485	.0468	.0452	.0433
.114	.1143	.0833	.0717	.0643	.0603	.0575	.0561	.0545	.0530	.0514	.0498	.0481	.0464	.0445
.117	.1173	.0855	.0736	.0660	.0619	.0590	.0576	.0559	.0544	.0528	.0511	.0494	.0476	.0456
.120	.1203	.0877	.0755	.0677	.0635	.0605	.0590	.0574	.0558	.0541	.0524	.0506	.0488	.0468
.123	.1234	.0899	.0774	.0694	.0651	.0620	.0605	.0588	.0572	.0555	.0538	.0519	.0501	.0480
.126	.1264	.0921	.0793	.0711	.0667	.0635	.0620	.0602	.0586	.0568	.0551	.0532	.0513	.0491
.129	.1294	.0943	.0811	.0728	.0682	.0650	.0635	.0617	.0600	.0582	.0564	.0544	.0525	.0503
.132	.1324	.0965	.0830	.0745	.0698	.0665	.0649	.0631	.0614	.0595	.0577	.0557	.0537	.0515
.135	.1354	.0987	.0849	.0761	.0714	.0680	.0664	.0645	.0628	.0609	.0590	.0570	.0549	.0527
.138	.1384	.1009	.0868	.0778	.0730	.0696	.0679	.0660	.0642	.0622	.0603	.0582	.0562	.0538
.141	.1414	.1031	.0887	.0795	.0746	.0711	.0694	.0674	.0656	.0636	.0616	.0595	.0574	.0550
.144	.1444	.1053	.0906	.0812	.0762	.0726	.0709	.0688	.0670	.0649	.0629	.0608	.0586	.0562
.147	.1474	.1075	.0925	.0829	.0778	.0741	.0723	.0703	.0684	.0663	.0642	.0620	.0598	.0573
.150	.1504	.1097	.0944	.0846	.0794	.0756	.0738	.0717	.0698	.0676	.0656	.0633	.0611	.0585
.153	.1535	.1118	.0962	.0863	.0809	.0771	.0753	.0731	.0712	.0690	.0669	.0646	.0623	.0597
.156	.1565	.1140	.0981	.0880	.0825	.0786	.0768	.0746	.0725	.0704	.0682	.0658	.0635	.0608
.159	.1595	.1162	.1000	.0897	.0841	.0801	.0782	.0760	.0739	.0717	.0695	.0671	.0647	.0620
.162	.1625	.1184	.1019	.0914	.0857	.0817	.0797	.0774	.0753	.0731	.0708	.0684	.0659	.0632
.165	.1655	.1206	.1038	.0931	.0873	.0832	.0812	.0789	.0767	.0744	.0721	.0696	.0672	.0644
.168	.1685	.1228	.1057	.0948	.0889	.0847	.0827	.0803	.0781	.0757	.0734	.0709	.0684	.0655
.171	.1715	.1250	.1076	.0964	.0905	.0862	.0841	.0817	.0795	.0771	.0747	.0722	.0696	.0667
.174	.1745	.1272	.1095	.0981	.0921	.0877	.0856	.0832	.0809	.0785	.0760	.0734	.0708	.0679
.177	.1775	.1294	.1113	.0998	.0936	.0892	.0871	.0846	.0823	.0798	.0774	.0747	.0720	.0690
.180	.1805	.1316	.1132	.1015	.0952	.0907	.0886	.0860	.0837	.0812	.0787	.0760	.0733	.0702
.183	.1835	.1338	.1151	.1032	.0968	.0922	.0906	.0875	.0851	.0825	.0800	.0772	.0745	.0714
.186	.1865	.1360	.1170	.1049	.0984	.0937	.0915	.0889	.0865	.0839	.0813	.0785	.0757	.0725
.189	.1896	.1382	.1189	.1066	.1000	.0953	.0930	.0903	.0879	.0852	.0826	.0798	.0769	.0737
.192	.1926	.1404	.1208	.1083	.1016	.0968	.0945	.0918	.0893	.0866	.0839	.0810	.0781	.0749
.195	.1956	.1426	.1227	.1100	.1032	.0983	.0959	.0932	.0907	.0879	.0852	.0823	.0794	.0761
.198	.1986	.1447	.1245	.1117	.1047	.0998	.0974	.0946	.0921	.0893	.0865	.0836	.0806	.0772
.201	.2016	.1469	.1264	.1134	.1063	.1013	.0989	.0961	.0935	.0907	.0878	.0848	.0818	.0784
.204	.2046	.1491	.1283	.1151	.1079	.1028	.1004	.0975	.0949	.0920	.0891	.0861	.0830	.0796
.207	.2076	.1513	.1302	.1167	.1095	.1043	.1018	.0989	.0963	.0934	.0905	.0874	.0842	.0807
.210	.2106	.1535	.1321	.1184	.1111	.1058	.1033	.1204	.0977	.0947	.0918	.0886	.0855	.0819
.213	.2136	.1557	.1340	.1201	.1127	.1074	.1048	.1018	.0990	.0961	.0931	.0899	.0867	.0831
.216	.2166	.1579	.1359	.1218	.1143	.1089	.1063	.1032	.1004	.0974	.0944	.0912	.0879	.0842
.219	.2197	.1601	.1378	.1235	.1159	.1104	.1077	.1047	.1018	.0988	.0957	.0924	.0891	.0854
.222	.2227	.1623	.1396	.1252	.1174	.1119	.1092	.1061	.1032	.1001	.0970	.0937	.0904	.0866
.225	.2257	.1645	.1415	.1269	.1190	.1134	.1107	.1076	.1046	.1015	.0983	.0950	.0916	.0878
.228	.2287	.1667	.1434	.1286	.1206	.1149	.1122	.1090	.1060	.1028	.0996	.0962	.0928	.0889
.231	.2317	.1689	.1453	.1303	.1222	.1164	.1137	.1104	.1074	.1042	.1009	.0975	.0940	.0901
.234	.2347	.1711	.1472	.1320	.1238	.1179	.1151	.1119	.1088	.1055	.1023	.0987	.0952	.0913
.237	.2377	.1732	.1491	.1337	.1254	.1194	.1166	.1133	.1102	.1069	.1036	.1000	.0965	.0924
.240	.2407	.1754	.1510	.1354	.1270	.1210	.1181	.1147	.1116	.1082	.1049	.1013	.0977	.0936
.243	.2437	.1776	.1528	.1371	.1285	.1225	.1196	.1162	.1130	.1096	.1062	.1025	.0989	.0948
.246	.2467	.1798	.1547	.1387	.1301	.1240	.1210	.1176	.1144	.1109	.1075	.1038	.1001	.0959
.249	.2497	.1820	.1566	.1404	.1317	.1255	.1225	.1190	.1158	.1123	.1088	.1051	.1013	.0971
.252	.2528	.1842	.1585	.1421	.1333	.1270	.1240	.1205	.1172	.1137	.1101	.1063	.1026	.0983
.255	.2558	.1864	.1604	.1438	.1349	.1285	.1255	.1219	.1186	.1150	.1114	.1076	.1038	.0995
.258	.2588	.1886	.1623	.1455	.1365	.1300	.1269	.1233	.1200	.1164	.1127	.1089	.1050	.1006
.261	.2618	.1908	.1642	.1472	.1381	.1315	.1284	.1248	.1214	.1177	.1141	.1101	.1062	.1018
.264	.2648	.1930	.1661	.1489	.1397	.1331	.1299	.1262	.1228	.1191	.1154	.1114	.1074	.1030
.267	.2678	.1952	.1679	.1506	.1412	.1346	.1314	.1276	.1242	.1204	.1167	.1127	.1087	.1041
.270	.2708	.1974	.1698	.1523	.1428	.1361	.1328	.1291	.1256	.1218	.1180	.1139	.1099	.1053
.273	.2738	.1996	.1717	.1540	.1444	.1376	.1343	.1305	.1269	.1231	.1193	.1152	.1111	.1065
.276	.2768	.2018	.1736	.1557	.1460	.1391	.1358	.1319	.1283	.1245	.1206	.1165	.1123	.1076
.279	.2798	.2039	.1755	.1574	.1476	.1406	.1373	.1334	.1297	.1258	.1219	.1177	.1136	.1088
.282	.2828	.2061	.1774	.1590	.1492	.1421	.1387	.1348	.1311	.1272	.1232	.1190	.1148	.1100
.285	.2859	.2083	.1793	.1607	.1508	.1436	.1402	.1362	.1325	.1285	.1245	.1203	.1160	.1112
.288	.2889	.2105	.1812	.1624	.1524	.1452	.1417	.1377	.1339	.1299	.1259	.1215	.1172	.1123

Conclusion

The mathematical foundation of this study is thus concluded, and there remains only the problem of establishing the linkage between this and the actual construction of the cable.

Number of Conductors	k	$k^{\frac{1}{2}}$	$1.1285dk^{\frac{1}{2}}$
2	.79	.889	1.003d
3	.42	.648	.731d
4	.31	.557	.629d
5	.25	.500	.564d
6	.22	.469	.529d
7	.20	.447	.504d
8	.19	.436	.492d
9	.18	.424	.478d
10	.17	.412	.465d
11-12	.16	.400	.451d
13-15	.15	.387	.437d
16-21	.14	.374	.422d
22-35	.13	.361	.407d
36,37	.12	.346	.390d

Cables Containing Four or Fewer Conductors

This is a trivial class, since the lay-up is completely familiar. It is made by a simple twisting operation with or without the use of core filler in the 3 or 4 conductor assembly.

Cables Containing from 5 to 8 Conductors

It is theoretically possible to make a multiconductor cable with all the conductors in one layer, however great their number may be. It would be necessary only that they be supported by a filler below and by a jacket above. This is rather far-fetched, however, and each manufacturer decides for himself, in the absence of any specification conflict, on the maximum number of conductors to be placed in the first layer over the jute core. From this point onward, all other positioning is at once pre-determined by the geometrical data developed earlier. The plan adopted in this shop is to confine to 8 the maximum number of conductors in this first layer. Accordingly, cables consisting of 5, 6, and 8 conductors are applied over a jute core in a single operation — the size of the jute required having been in advance determined by consulting table III. The seven conductor cable, like the 19, 37, etc., presents no problems since these are built up from a core of one conductor by simply adding layers of 6, 12, 18, etc.

DIAMETERS OF COTTON YARN

$\times 10^{-5}$

Size	1 Ply	2 Ply	3 Ply	4 Ply
1	2790	4454	5580	6585
2	1973	3157	3946	4657
3	1611	2578	3222	3802
4	1395	2232	2790	3293
5	1248	1997	2496	2945
6	1139	1823	2278	2689
7	1055	1687	2109	2489
8	987.0	1579	1973	2328
9	930.0	1488	1860	2195
10	882.5	1412	1765	2083
11	841.0	1346	1683	1986
12	805.5	1289	1611	1901
13	774.0	1238	1548	1827
14	745.5	1193	1492	1760
15	720.5	1153	1441	1701
16	697.5	1116	1395	1647
17	676.5	1083	1354	1597
18	657.5	1052	1315	1552
19	640.0	1024	1280	1511
20	624.0	998.0	1248	1473
21	609.0	974.0	1218	1437
22	595.0	951.5	1190	1404
23	582.0	931.0	1164	1373
24	569.5	911.0	1139	1344
25	558.0	893.0	1116	1317

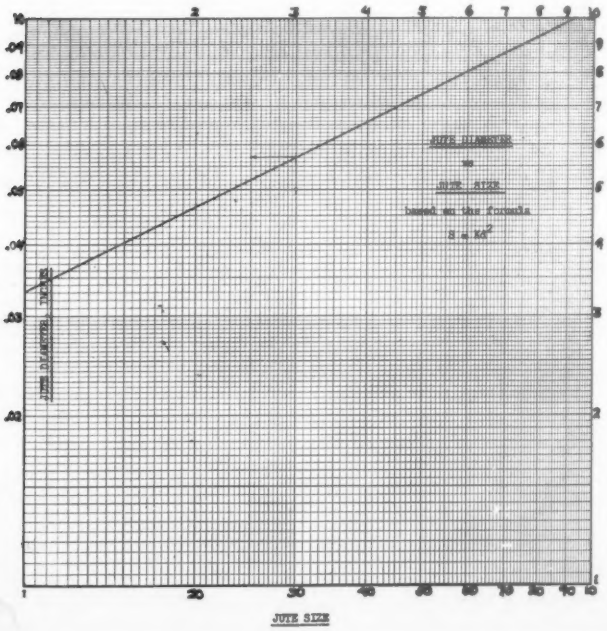
Based on the formula $t = .0279k(S)^{\frac{1}{2}}$

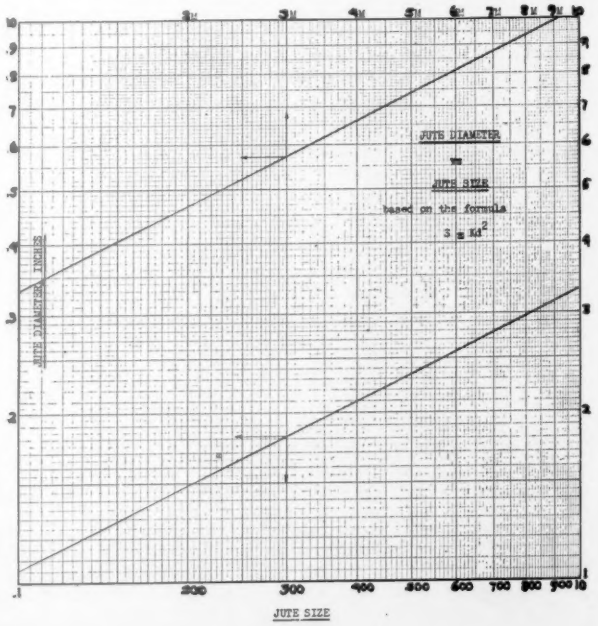
where

t = thickness of yarn
S = cotton yarn size
k = cabling factor
= 1.0 for single ply yarn
= 1.6 for 2-ply yarn
= 2.0 for 3-ply yarn
= 2.36 for 4-ply yarn

Cables Containing from 9 to 19 Conductors

At the level 9, one conductor is used as a core and the other 8 are applied concentrically over it, provided that a jute bedding has first been introduced beneath this layer of 8. Since a maximum of 6 can at best be applied over 1 without crowding, the build-up in diameter by means of jute or other suitable material becomes essential. The jute to be used as bedding, in terms of size and ends, are selected from table II. In the case of 19 conductors, of course, the matter is greatly simplified because no bedding is in this case required. Only fillage of the valleys is a problem here, but the formulas and the table given in connection





CONTROL CABLE CONSTRUCTION LAY-UP

ALL CONDUCTORS ALIKE

PLAN I

Cdrs. (1)	Construction Lay-up (2)	K (3)
1	1	1.000
2	2	2.000
3	3	2.155
4	4	2.414
5	J5	2.701
6	J6	3.000
7	1 - 6	3.000
8	1 - J7	3.305
9	1 - J8	3.613
10	1 - J9	3.924
11	2 - 9	4.000
12	3 - 9	4.155
13	3 - J10	4.236
14	J4 - 10	4.414
15	J4 - J11	4.549
16	J5 - 11	4.701
17	J5 - J12	4.864
18	J6 - 12	5.000
19	1 - 6 - 12	5.000
20	1 - 6 - J13	5.177
21	1 - J7 - 13	5.305
22	1 - J7 - J14	5.496
23	1 - J8 - 14	5.613
24	1 - J8 - J15	5.810
25	1 - J9 - 15	5.924
26	2 - 9 - 15	6.000
27	2 - 9 - J16	6.126
28	3 - 9 - 16	6.155
29	J4 - 10 - 15	6.414
30	J4 - 10 - 16	6.414
31	J4 - 10 - J17	6.444
32	J4 - J11 - 17	6.549
33	J5 - 11 - 17	6.701
34	J5 - 11 - 18	6.701
35	J5 - J12 - 18	6.864
36	J6 - 12 - 18	7.000
37	1 - 6 - 12 - 18	7.000
38	1 - 6 - 12 - J19	7.079
39	1 - 6 - J13 - 19	7.177
40	1 - J7 - 13 - 19	7.305
41	1 - J7 - 13 - J20	7.394
42	1 - J7 - J14 - 20	7.496
43	1 - J8 - 14 - 20	7.613
44	1 - J8 - 14 - J21	7.711
45	1 - J8 - J15 - 21	7.810
46	1 - J9 - 15 - 21	7.924
47	2 - 9 - 15 - 21	8.000
48	2 - 9 - 15 - 22	8.000
49	2 - 9 - J16 - 22	8.126
50	3 - 9 - 16 - 22	8.155
51	3 - J10 - 16 - 22	8.236
52	J4 - 10 - 15 - 23	8.414
53	J4 - 10 - 16 - 23	8.414
54	J4 - 10 - J17 - 23	8.444
55	J4 - J11 - 17 - 23	8.549
56	J5 - 11 - 17 - 23	8.701
57	J5 - 11 - 17 - 24	8.701
58	J5 - 11 - J18 - 24	8.757
59	J5 - J12 - 18 - 24	8.864
60	J6 - 12 - 18 - 24	9.000
61	1 - 6 - 12 - 18 - 24	9.000
62	1 - 6 - 12 - 18 - 25	9.000
63	1 - 6 - 12 - J19 - 25	9.079
64	1 - 6 - J13 - 19 - 25	9.177
65	1 - J7 - 13 - 19 - 25	9.305
66	1 - J7 - 13 - 19 - 26	9.305
67	1 - 7 - 13 - 20 - J26	9.394
68	1 - J7 - J14 - 20 - 26	9.496
69	1 - J8 - 14 - 20 - 26	9.613
70	1 - J8 - 14 - 20 - 27	9.613
71	1 - J8 - 14 - J21 - 27	9.711
72	1 - J8 - J15 - 21 - 27	9.810
73	1 - J9 - 15 - 21 - 27	9.924
74	1 - J9 - 15 - 21 - 28	9.924

with proposition 2 makes it possible to determine the needed data at once.

Cables Containing More Than 19 Conductors

The approach to these larger cables is identical to that given in the preceding paragraphs. The difference is only in complexity, not in principle. The actual make-up of multiconductor cables is given in the ensuing tables, where some of the boxhead titles and their significance are explained in footnotes. It must in all cases be understood that lay-ups other than those given here are entirely possible although as stated earlier the first layer does in effect predetermine the entire construction.

CONTROL CABLE CONSTRUCTION LAY-UP

ALL CONDUCTORS ALIKE

PLAN I

Cdrs. (1)	Construction Lay-up (2)	K (3)
75	2 - 9 - 15 - 21 - 28	10.000
76	2 - 9 - 15 - 22 - 28	10.000
77	2 - 9 - J16 - 22 - 28	10.126
78	3 - 9 - 16 - 22 - 28	10.155
79	3 - J10 - 16 - 22 - 28	10.236
80	3 - J10 - 16 - 22 - 29	10.236
81	3 - J10 - 16 - 23 - 29	10.337
82	J4 - 10 - 16 - 23 - 29	10.414
83	J4 - 10 - J17 - 23 - 29	10.444
84	J4 - J11 - 17 - 23 - 29	10.549
85	J4 - J11 - 17 - 23 - 30	10.549
86	J5 - 11 - 17 - 23 - 30	10.701
87	J5 - 11 - 17 - 24 - 30	10.701
88	J5 - 11 - J18 - 24 - 30	10.757
89	J5 - J12 - 18 - 24 - 30	10.864
90	J5 - J12 - 18 - 24 - 31	10.864
91	J6 - 12 - 18 - 24 - 31	11.000
92	1 - 6 - 12 - 18 - 24 - 31	11.000
93	1 - 6 - 12 - 18 - 25 - 31	11.000
94	1 - 6 - 12 - J19 - 25 - 31	11.079
95	1 - 6 - J13 - 19 - 25 - 31	11.177
96	1 - J7 - 13 - 19 - 25 - 31	11.305
97	1 - J7 - 13 - 19 - 25 - 32	11.305
98	1 - J7 - 13 - 19 - 26 - 32	11.305
99	1 - J7 - 13 - J20 - 26 - 32	11.394

(2) The letter J indicates the presence of filler under the indicated layer.

(3) The core diameter is obtained by multiplying the OD of one conductor by the value of K in the last column

Notes

The values listed under the first five boxheads of Plan II have been derived from the formulas given earlier. An explanation of the symbols N_c, N_e, and N_1 are all that is required to conclude this article.

★ ★ ★

N_c This represents the number of conductors derived from a literal application of the formulas of Proposition 1, where the derivation was based on the assumption that all conductors are laid parallel to the axis of the finished cable.

★ ★ ★

N_e Actually, however, the conductors are always applied spirally, and the

CONTROL CABLE CONSTRUCTION LAY-UP

ALL CONDUCTORS ALIKE

PLAN II

Conductors per Layer (1)	N (2)	D/d-K (3)	K+1 (4)	1/(K+1) (5)	Arc Sin 1/(K+1) (6)	Nc (7)	Ne (8)	N1 (9)	OD (10)
1	1	1.000	2.000	.500	30.00°	6.00	5.87	6	3.000d
2	2	2.000	3.000	.333	19.47°	9.24	9.04	9	4.000d
3	3	2.155	3.155	.317	18.48°	9.74	9.53	9,10	4.155d
4	4	2.414	3.414	.293	17.03°	10.57	10.35	10	4.414d
5	5	2.701	3.701	.270	15.67°	11.49	11.25	11	4.701d
6	6	3.000	4.000	.250	14.47°	12.44	12.18	12	5.000d
7	7	3.305	4.305	.232	13.42°	13.41	13.13	13	5.305d
8	8	3.613	4.613	.217	12.53°	14.37	14.07	14	5.613d
9	9	3.924	4.924	.203	11.72°	15.36	15.04	15	5.924d
10	10	4.236	5.236	.191	11.02°	16.33	15.99	16	6.236d
1 - 6	7	3.000	4.000	.250	14.47°	12.44	12.18	12	5.000d
2 - 9	11	4.000	5.000	.200	11.53°	15.61	15.28	15	6.000d
3 - 9	12	4.155	5.155	.194	11.18°	16.10	15.76	16	6.155d
3 - 10	13	4.155	5.155	.194	11.18°	16.10	15.76	16	6.155d
4 - 10	14	4.414	5.414	.186	10.67°	16.87	16.52	16,17	6.414d
5 - 11	16	4.701	5.701	.175	10.08°	17.85	17.48	17,18	6.701d
6 - 12	18	5.000	6.000	.167	9.62°	18.71	18.32	18	7.000d
1 - 6 - 12	19	5.000	6.000	.167	9.62°	18.71	18.32	18	7.000d
7 - 13	20	5.305	6.305	.159	9.15°	19.67	19.26	19	7.305d
8 - 14	22	5.613	6.613	.151	8.68°	20.74	20.30	20	7.613d
9 - 15	24	5.924	6.924	.144	8.28°	21.74	21.28	21	7.924d
1 - 6 - 12	19	5.000	6.000	.167	9.62°	18.71	18.32	18	7.000d
2 - 9 - 15	26	6.000	7.000	.143	8.22°	21.89	21.43	21,22	8.000d
3 - 9 - 16	28	6.155	7.155	.140	8.05°	22.36	21.89	22	8.155d
3 - 10 - 16	29	6.155	7.155	.140	8.05°	22.36	21.89	22	8.155d
4 - 10 - 16	30	6.414	7.414	.135	7.77°	23.16	22.67	23	8.414d
4 - 10 - 17	31	6.414	7.414	.135	7.77°	23.16	22.67	23	8.414d
5 - 11 - 17	33	6.701	7.701	.130	7.47°	24.09	23.58	23,24	8.701d
5 - 11 - 18	34	6.701	7.701	.130	7.47°	24.09	23.58	23,24	8.701d
6 - 12 - 18	36	7.000	8.000	.125	7.18°	25.06	24.53	24,25	9.000d
1 - 6 - 12 - 18	37	7.000	8.000	.125	7.18°	25.06	24.53	24,25	9.000d
7 - 13 - 19	39	7.305	8.305	.120	6.90°	26.09	25.54	25,26	9.305d
8 - 14 - 20	42	7.613	8.613	.116	6.67°	26.99	26.42	26,27	9.613d
9 - 15 - 21	45	7.924	8.924	.112	6.43°	27.99	27.40	27,28	9.924d
2 - 9 - 15 - 21	47	8.000	9.000	.111	6.38°	28.21	27.62	28	10.000d
2 - 9 - 15 - 22	48	8.000	9.000	.111	6.38°	28.21	27.62	28	10.000d
3 - 9 - 16 - 22	50	8.155	9.155	.109	6.27°	28.71	28.11	28	10.155d
3 - 10 - 16 - 22	51	8.155	9.155	.109	6.27°	28.71	28.11	28	10.155d
4 - 10 - 16 - 23	53	8.414	9.414	.106	6.10°	29.51	28.89	29	10.414d

CONTROL CABLE CONSTRUCTION LAY-UP

ALL CONDUCTORS ALIKE

PLAN II

Conductors per Layer	N	D/d-K	K+1	1/(K+1)	Arc Sin 1/(K+1)	Nc	Ne	Ni	OD
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4-10-17-23	54	8.414	9.414	.1062	6.10°	29.51	28.89	29	10.414d
5-11-17-23	56	8.701	9.701	.1031	5.92°	30.41	29.77	30	10.701d
5-11-17-24	57	8.701	9.701	.1031	5.92°	30.41	29.77	30	10.701d
5-11-18-24	58	8.701	9.701	.1031	5.92°	30.41	29.77	30	10.701d
6-12-18-24	60	9.000	10.000	.1000	5.73°	31.41	30.75	31	11.000d
1- 6-12-18-24	61	9.000	10.000	.1000	5.73°	31.41	30.75	31	11.000d
1- 6-12-18-25	62	9.000	10.000	.1000	5.73°	31.41	30.75	31	11.000d
7-13-19-25	64	9.305	10.305	.0970	5.57°	32.32	31.64	32	11.305d
7-13-19-26	65	9.305	10.305	.0970	5.57°	32.32	31.64	32	11.305d
8-14-20-26	68	9.613	10.613	.0942	5.40°	33.33	32.63	33	11.613d
8-14-20-27	69	9.613	10.613	.0942	5.40°	33.33	32.63	33	11.613d
9-15-21-27	72	9.924	10.924	.0915	5.25°	34.29	33.57	33,34	11.924d
9-15-21-28	73	9.924	10.924	.0915	5.25°	34.29	33.57	33,34	11.924d
10-16-22-29	77	10.24	11.24	.0890	5.10°	35.29	34.55	34,35	12.236d

(7), (8), (9) For an explanation of these quantities see the ensuing text.

angle of application is always given by implication in the requirement that the lay shall be a certain number of times as large as the OD of the layer being applied. Since this value of lay is most often prescribed as 15, i.e.,

$$\text{Lay} = 15D$$

the value of the angle of application is 11° 50". For,

$$\text{Tan}\,\theta = \pi D/15D$$
$$= \pi/15$$
$$= .20944$$

Whence, $\theta = 11° 50''$

The effective increase in diameter resulting from the spiral application of a cylinder of diameter d is a function of the secant value of the angle and is equivalent to the increase of a projected diameter upon a plane held obliquely thereto. This is, in effect, an elliptical coefficient of increase which is taken into account in these tables by reducing the values of N_c by dividing the secant of 11° 50", or, by 1.0217.

* * *

N_1 Nor can the number of conductors applied in a layer be anything but an integer. Accordingly, the values of N_e are rounded out to the nearest integer except that any decimal fraction lying between .40 and .60, i.e., approximately ½ is considered as meaning that either of 2 values of N_1 are equally satisfactory. This is sound from an engineering point of view since in the manufacturing process strict mathematical precision is unattainable and a little unnoticeable squeezing or play will permit the accommodation of either number of conductors.

* * *

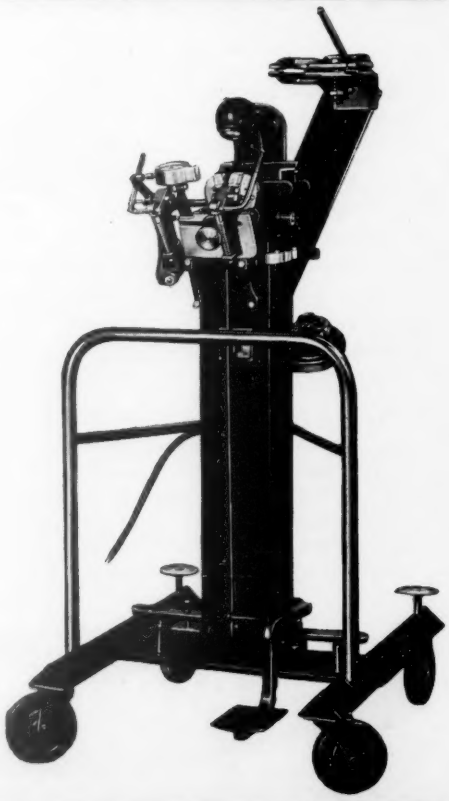
N Actually 2 sets of tables showing make-up are provided here. The one headed Plan II is confined to constructions where no jute bedding is required. Plan I is the more general table in which the constructions involving jute bedding have also been included. Although values of N_c, N_e, and N_1 are not columnarly tabulated in this table, they have nevertheless been taken into account.

MICROMETER PRECISION — MICRO-WELD — TRADE MARK REGISTERED

MODELS J-3-S and J-4-S AUTOMATIC MICRO-WELD BUTT WELDERS

These welders are used for welding high and low carbon STEEL, and STEEL ALLOY wire, ranging in size from .020" to .160" diameter. All operations on these units, which include the clamping of the wire being welded, contacting the welding switch, and upsetting the weld, are made by a single downward stroke of the foot pedal. Welders for high carbon steel wire are equipped with the exclusive MICRO-WELD Dial indicating annealing device to facilitate the annealing operation of high carbon wire.

Standard equipment with these units include annealing dies, filing vise, light extension cord, and mounting on a 4-wheel truck. Special units can be furnished for crane mounting.



MICRO PRODUCTS CO.

20 NO. WACKER DR., CHICAGO 6, ILL.

Telephone: STATE 2-7468

First in your file . . .
Apco Mossberg Company
Product: Steel reels, spools, bobbins
Address: Attleboro, Massachusetts
Telephone: Attleboro 1-0340

FIRST IN QUALITY!

Whether you're looking for steel reels, spools or bobbins, you're sure to find the quality and service you expect under the world-famed *Apco Mossberg* name.

Backed by more than half a century of experience, *Apco Mossberg* engineers and craftsmen are prepared to meet your complete requirements for standard or custom-made reels, spools and bobbins . . . each to exact size, balance and trueness.

Be sure to look for the *Apco Mossberg* name the next time you consult your buyer's guide or product register. Our engineering and service departments will gladly submit recommendations based on your specifications at no obligation.

Write, wire or phone Attleboro 1-0340 collect today.

Pacific Coast Representative:
Gordon H. Proffitt
World Trade Center
Ferry Building
San Francisco 11, California

Canadian Representative:
Hugh P. Williams & Co.
47 Colburne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

1956 Supplements to Book of ASTM Standards

Part 1. Ferrous Metals — 440 pages. Includes 48 standards covering steel pipe; steel tubes; steel forged or rolled pipe, fittings and welding fittings; steel castings; steel bolting materials; boiler steel plates and rivets; structural and rivet steel; steel rails and accessories; rolled railroad wheels and tires; spring steel and steel springs; steel chain; corrosion resisting and heat resisting steels; cast iron; and nodular iron. (available January 1957)

★ ★ ★

Part 2. Non-Ferrous Metals—360 pages. Includes 60 standards covering copper and copper base alloys; nickel and nickel base alloys; electrical resistance and related alloys; metal powders and products; die cast metals and alloys; aluminum and aluminum alloys; magnesium and magnesium base alloys; and metallic electrical conductors. (available immediately)

★ ★ ★

Part 6. Rubber, Plastics, Electrical Insulating Materials — 380 pages. Includes 71 standards covering plastics; electrical insulating materials; rubber products (processibility tests, interlaboratory tests, synthetic elastomers, physical tests for vulcanized rubber, low temperature tests of rubber, automotive and aeronautical rubber, packing and gasket materials, hose, electrical protective equipment, insulating wire and cable, latex foam sponge and expanded cellular rubber, non-rigid plastics); and electronics materials. (available January 1957)

★ ★ ★

Part 7. Textiles, Soap, Water, Paper, Adhesives, Shipping Containers, Atmospheric Analysis — 220 pages. Includes 34 standards covering textile materials (fibers, yarns, threads, cordage, fabrics, cotton, rayon, acetate, silk, wool); soap and other detergents; paper and paper products; shipping containers; adhesives; water; and atmospheric sampling tests. (available immediately)

★ ★ ★

There are seven parts, only those of interest to the wire industry having been mentioned. The 1956 Supplements, in heavy paper covers, can be obtained from the **American Society for Testing Materials,** 1916 Race Street, Philadelphia 3, Pa., at $4.00 per part—or $28.00 for the complete set of seven parts.

National Bureau of Standards to Move

A tract of approximately 550 acres of land near Gaithersburg, Md., has been selected for relocation of the Washington laboratories of the **National Bureau of Standards.** The move will permit the Bureau to plan new buildings to replace present research facilities, which over the past 50 years have become inadequate for current needs.

★ ★ ★

The new site was selected after careful consideration as most suited to the special requirements of the Bureau's scientific and engineering programs.

New AVA Manual

A new Manual on National Electrical Code Type AVA Cables covers application and design data for Three Conductor Armored Cables and Single Conductor Cable in Conduit.

★ ★ ★

These comparisons are conveniently tabulated to cover such major considerations as Circuit Length (1 volt drop at rated current), Capacity and Regulation Comparisons, and Economic and Physical Comparisons in the selection of this type of cables. A section of the Manual covers component parts such as terminators and cable racks.

★ ★ ★

Useful engineering data on insulated cables provide the necessary information to calculate conductor sizes and circuit data on the common types of wire used today in 600 volt secondary distribution systems.

★ ★ ★

Copies of the manual may be secured by writing **Rockbestos Products Corp.,** New Haven 4, Conn.

NOW the TINIUS OLSEN
ElecTmatic
LO-CAP
UNIVERSAL TESTING MACHINE

This 1000 lb. capacity ElecTmatic LO-CAP is equipped with Type KR Grips for rapid, efficient testing of wire samples in a leading wire mill.

CAPACITIES TO 5000 LBS.
Ideal for testing wire and other specimens, Olsen LO-CAPS are available in standard capacities of 100, 200, 500, 1000, 2000 or 5000 lbs. Higher capacities are also available.

SelecTrange DIAL INDICATION
Load is indicated on the 15-inch color coded dial using the exclusive Olsen Torque Bar Weighing System.

POSITIVE TESTING SPEEDS
. . . infinitely variable crosshead speeds from 0.3 to 12 inches per minute. Speeds are positive under load or no load.

COMPACT
Entire machine occupies less than five square feet of floor space.

CHANGE RANGES DURING TEST
Either of two range capacities—full range and ¼, ⅛ or 1/10 capacity—are instantly available with a flip of the SelecTrange switch.

UNMATCHED FLEXIBILITY
. . . for tension, compression or flexure testing. Stress-strain curves can be made with LO-CAPS equipped with an Olsen electronic recorder, using strain instrumentation—even when "fragile" specimens such as cellophane, fine wire, etc. are tested.

Get the full story.
WRITE TODAY
FOR BULLETIN 54.

TINIUS OLSEN
TESTING MACHINE COMPANY
2140 EASTON RD. WILLOW GROVE, PA.
Testing and Balancing Machines

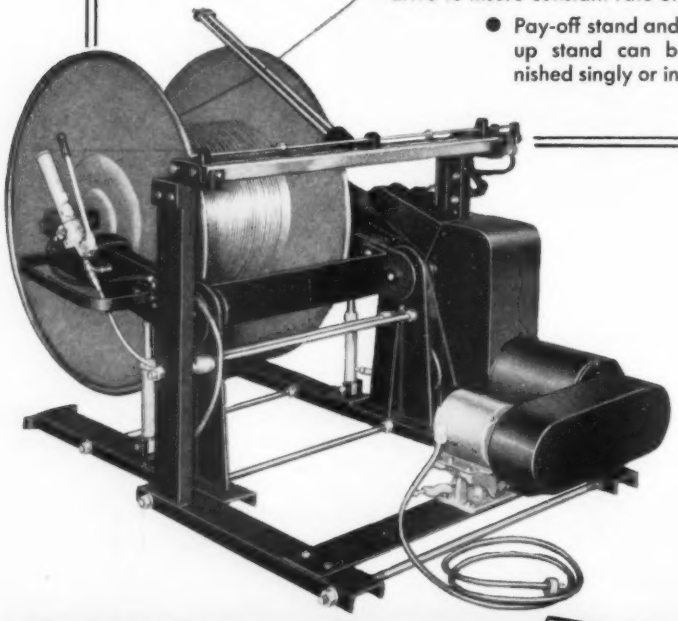
Trademark
Reg. U.S. Pat. Off.

NEW WARDWELLIAN®

PAY-OFF STAND and WINDUP STAND

For Delivering Wire and Cable to Various Types of Production Machines and Winding Product on Reels

- Pay-off stand and windup stand will accommodate reels from 30" to 48" in diameter. Maximum weight of full reel 5000 pounds. Adjustable traverse up to 32" maximum.
- Stands to accommodate reels of greater diameter can be furnished upon request at additional cost.
- Reels raised and lowered hydraulically on both pay-off stand and windup stand.
- Pay-off stand equipped with adjustable friction-control for desired tension of delivery.
- Windup stand equipped with adjustable traverse mechanism.
- Windup stand operated by individual motor through fluid-drive to insure constant rate of draft.
- Pay-off stand and windup stand can be furnished singly or in pairs.



WARDWELL BRAIDING MACHINE CO.

1212 HIGH STREET
CENTRAL FALLS
RHODE ISLAND, U. S. A.

Representatives for Europe, British Colonies and Dependencies
JAMES MACKIE & SONS, LTD., BELFAST, IRELAND

ASTM Activities

Committee A-5 on Corrosion of Iron and Steel is developing specifications for zinc-coated armor wire and for flat armoring tape or wire. The results of over 1000 tests of coating weights on hardware will be studied with the object of revising the present weights of coating in Table I of Specifications A 153. Other new projects include the preparation of a recommended practice on inspection of galvanizing and a study of the problem of regalvanizing of material by job galvanizers. Another sub-committee is studying methods of test for aluminum-coated and zinc-coated steels and will initiate exposure tests when a sufficient number of producers are manufacturing aluminum-coated steel.

★ ★ ★

Committee B-5 on Copper is preparing a specification for tin-coated copper. Also in preparation are a new specification for copper-silicon alloy pipe and tube and requirements for 5S and 10S pipe schedules. Development of a recommended practice on dimensional measurements is another project.

★ ★ ★

Committee D-9 on Electrical Insulating Materials which is developing test methods to evaluate high-temperature performance of insulation. Because it is concerned with insulating materials of all types, it has joint interests with other committees of the Society, one a project on electrical ceramics and another on plastics, rubber and petroleum products used for electrical insulation.

★ ★ ★

Committee D-11 on Rubber is currently revising the Wire and Cable Construction Specification (D 1350) to include knitted and wrapped coverings, and nylon-, rayon- and glass-braid coverings. The committee is also revising the specifications on polyethylene insulated cable to incorporate characteristics of the newer high-density polyethylenes recently placed on the market.

★ ★ ★

Committee B-1 on Wires for Electrical Conductors is analyzing data on the commercial production of soft, square and rectangular copper wire, to be used as a basis for establishing acceptance limits when tested in accordance with the Tentative Method of Test for Stiffness of Bare, Soft, Square, and Rectangular Copper Wire for Magnet Wire Fabrication (ASTM Designation: B 279). The committee is also considering the possibility of developing an industry-standard test-report form for reporting results of tests on bare conductors. A task group will work on specifications for aluminum-coated steel core wire for ACSR constructions. Other projects include the preparation of specifications for aluminum strap for magnet wire and for aluminum wire for communication (telephone) cable.

Guide to NEMA Standards

More than 150 Standards Publications developed by subdivisions of the **National Electrical Manufacturers Association** are described in a 17-page booklet that now is available without charge from the Association's headquarters, 155 East 44th Street, New York 17, N. Y., it is announced by **Joseph F. Miller,** Managing Director of NEMA.

★ ★ ★

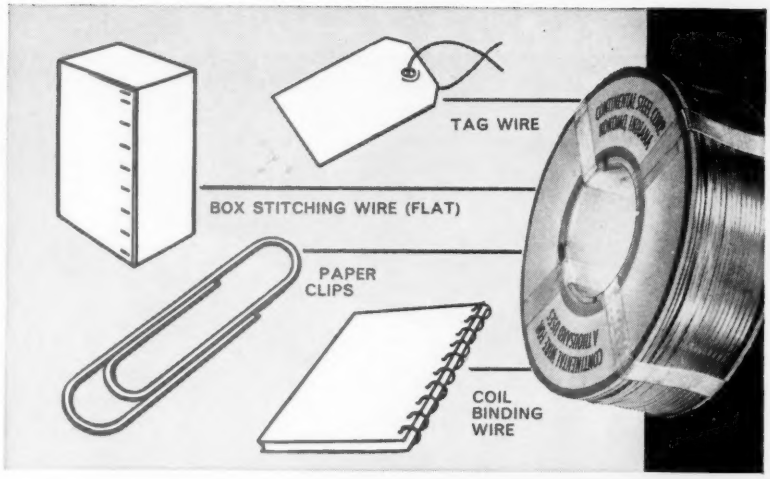
Entitled "Your Guide to NEMA Standards Publications," the comprehensive booklet briefly describes standards covering eight electrical classifications: appliances, illuminating equipment, signalling and communication equipment, industrial apparatus, building equipment and supplies, insulating materials, insulated wire and cable, and generation, transmission and distribution equipment.

★ ★ ★

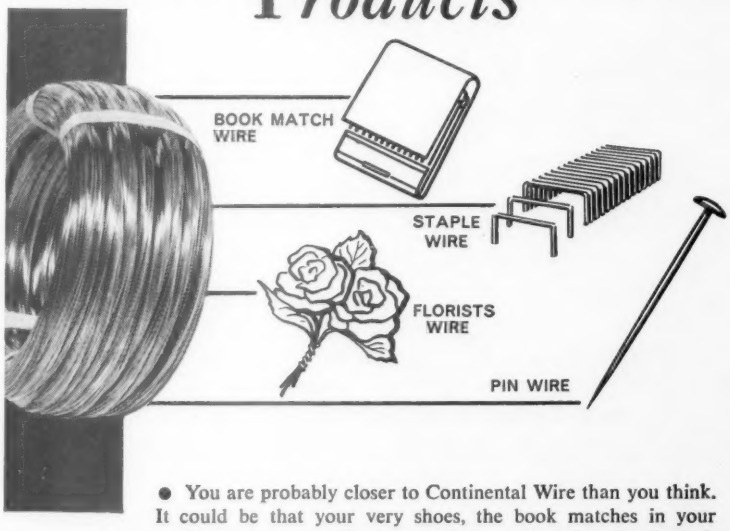
The new Guide—first such produced by NEMA since 1951—is of assistance to both manufacturers and their industrial customers since it will enable each to select at a glance those publications in which they are particularly interested.

★ ★ ★

A price list of these publications will be sent free on request.



Fine and Specialty Wire for Super Fine Products



● You are probably closer to Continental Wire than you think. It could be that your very shoes, the book matches in your pocket or the paper clips in your desk—were made using dependable Continental Fine Wire! That's because Continental is preferred by hundreds of leading firms for literally thousands of different fine wire applications. For super fine products—you, too, should try Continental Fine and Specialty Wire, available in many sizes, of almost any temper, finish or analysis, in low carbon and medium low carbon steels.

For the finest in fine wire—call in Continental!

CONTINENTAL

STEEL CORPORATION • KOKOMO, INDIANA

Wire Specialists for over half a Century

PRODUCERS OF: Manufacturers' Wire in many sizes, tempers, and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, and special shaped wire. Also Welded Wire Reinforcing Fabric, Nails, Continental Chain Link Fence, and other products.

Ad No. 956 – 3092

...and here's why!

Now you can enjoy lower freight charges and greater protection against damage with the new, lighter weight NYECO steel reels. They cost so little more, last 12 times longer than wooden reels, require minimum maintenance. Rugged weatherproof, splinter-proof, warp-proof protection protects costly cable against damage due to dropping, bouncing, rough handling.

Think it over and you'll agree that it doesn't pay to risk an investment of thousands . . . and your reputation . . . on inferior reels.

* These leading mills are just a few of the many that use NYECO Steel Reels: ANACONDA, GENERAL CABLE, OKONITE, PHELPS DODGE, ROEBLING, WESTERN ELECTRIC

- *ANY QUANTITY*
- *ANY SIZE*
- *ANY LOAD*
- *FLANGE DIAMETER From 36" UP*

Write • Phone • Wire

NYECO

Specialists to the Wire Industries for Over 45 Years

NEW YORK ENGINEERING COMPANY

75 West Street, New York 6, N. Y.

TELEPHONE: WHitehall 4-5380 **CABLE:** NYECO, N. Y. **PLANTS:** YONKERS, N. Y.

Wallace Barnes to Observe Centenary

The Wallace Barnes Company, division of the **Associated Spring Corporation,** a major manufacturer of coil springs, is preparing for the observance of its 100th anniversary. The firm which started in 1857 with three employees is now the largest unit of a corporation which spans the nation, providing employment for more than 4,000 workers.

★ ★ ★

Carl F. Barnes, great grandson of **Wallace Barnes,** founder, is president of the corporation. He is the fourth generation of the Barnes family to head the company.

★ ★ ★

Arrangements for the centennial celebration have been assigned to a committee headed by **G. Theodore Zahnke,** general manager.

★ ★ ★

Two former general managers of the division are still actively engaged with the company and will assist in the preparations. They are **Ernest L. Goff,** executive vice president of the Associated Spring Corporation and **Walter F. Froehlich,** vice president of the corporation.

★ ★ ★

The firm's name was known as the Wallace Barnes until 1897 when it was incorporated as the Wallace Barnes Company. In 1922 it merged with several other spring manufacturing companies of the nation and adopted its present official title, the Associated Spring Corporation, with plants in Bristol, Chicago, Corry, Pa., Detroit, Mich., and Hamilton, Canada.

★ ★ ★

The new company turned out clock and toy springs, hoop skirts, springs for the clock companies of the state; lamp springs; springs for burglar alarms, curtains, doors, knitting machines, looms and steel wire for needles; trouser guards for bicycle riders; flat coil springs for "the talking machine" and springs of every description for every purpose down to the present automotive, aircraft age, with an outstanding record of production for various types of firearms in national emergencies.

Guide to Spring Design Offered

The fundamentals of spring design—presented in quick, easy-to-grasp form and in sufficient detail to guide the product designer through the initial stages of a spring design problem — are set forth in a new 8-page brochure: "Spring Design and Selection—in Brief," which has just been published by **Associated Spring Corp.**, Bristol, Conn.

★ ★ ★

The brochure contains the basic stress and deflection formulas, the commonly used spring materials, typical applications, and certain limitations for each of the various types of springs—round wire compression springs, square wire compression springs, rolled or rectangular wire compression springs, volute springs, conical compression springs (single and double taper), high duty compression springs (such as valve springs), torsion bars, extension springs, round and rectangular wire torsion springs, cantilever and elliptical type flat springs, spiral or brush springs made of flat wire, control springs, high temperature springs, clock or motor power springs, Belleville spring washers, curved spring washers, wavy spring washers, and hair-springs.

★ ★ ★

A tabulation of the tensile, torsional, and other physical properties of the commonly used spring materials, and notes on the process of manufacture and the chief uses of each is also included.

★ ★ ★

Fifteen charts and graphs help make this a comprehensive analysis of spring design and selection.

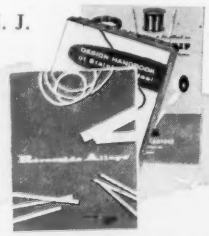
★ ★ ★

Copies may be obtained free on request from any of the twelve manufacturing divisions of Associated Spring Corp., located in the principal industrial centers of the U. S. and Canada, or from the Corporation's headquarters, Bristol, Conn.

You're welcome to our technical service

Here's a word of advice, just in case you run into a problem in metal selection, fabrication or machining . . . or are faced with unusual service conditions or product requirements. You can get help from Riverside-Alloy's Technical Service Dept. Their wide experience with non-ferrous alloys through the years is at your service. Expert technical service is a Riverside-Alloy extra that stands behind our line of phosphor bronze, nickel silver, cupro-nickel, beryllium copper, stainless steel and nickel alloys. For information on our quality wire, rod and strip for your products, write to Riverside-Alloy Metal Division, H. K. Porter Company, Inc., Riverside, N. J.

Send today for our free handbooks



ALLOY METAL WIRE
Prospect Park, Pa.

RIVERSIDE METAL
Riverside, N.J.

PRENTISS WIRE MILLS
Holyoke, Mass.

HKP RIVERSIDE-ALLOY METAL DIVISION
H. K. PORTER COMPANY, INC.

Outstanding Personalities of the Wire Industry

Honor President of Rome Cable Corporation

Top executives of the nation's wire and cable companies joined on January 8th in honoring **A. D. R. Fraser,** President, **Rome Cable Corporation,** Rome, N. Y., for the contributions which he has made to the industry during his 2-year term as chairman of the Wire and Cable Section, **National Electrical Manufacturers Association.**

★ ★ ★

Mr. Fraser's retirement as chairman of the Section was marked by a dinner in his honor at the Savoy-Plaza Hotel in New York. His successor as Section chairman, **B. F. Isley,** General Manager, Wire and Cable Department, **General Electric Company,** Bridgeport, Conn., presided at the event.

★ ★ ★

Mr. Fraser, a native of Scotland, began his business career with Remington Cash Register Company after graduation from Clark University in 1922. After working for **Rome Wire Company** and for **General Cable Corporation,** he became one of the founders of **Rome Cable Corporation** in 1936.

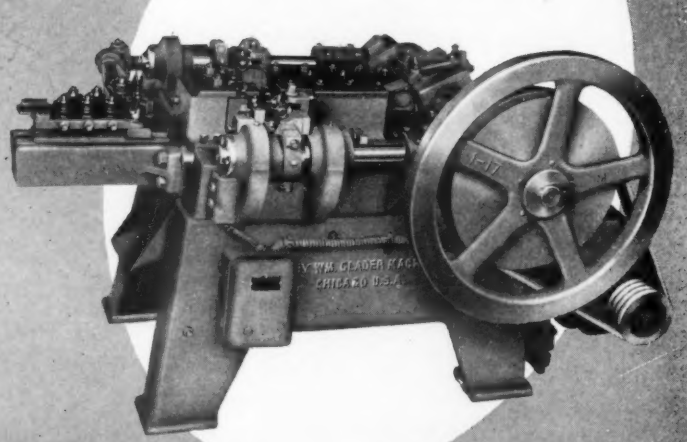
A. D. R. Fraser, left, as he received gift from NEMA's Wire and Cable Section, presented by B. F. Ilsley, right. * * * * * * *

Under Mr. Fraser's guidance, the NEMA Wire and Cable Section has grown in membership and importance throughout the electrical industry. He initiated the formation of four new highly effective committees in marketing and statistics, accounting and financial, industry relations and traffic. The Magnet Wire Technical Committee also increased its work of developing magnet wire standards during his chairmanship.

★ ★ ★

A feature of Mr. Fraser's stepped-up Section program is the holding of two semi-annual conventions at which leaders in industry, government and other fields report on and discuss activities of interest to the wire and cable manufacturers. In addition, it also is planned to have a third Section program which will be tied in with the annual convention of NEMA, currently held in November.

high efficiency—low cost
with GLADER wire nail machines



Eliminate costly down-time in the Nail Mill by replacing obsolete machines with new GLADER NAIL MACHINES . . . For tops in efficiency and economical operation use GLADERS.

WM. GLADER
MACHINE WORKS

210 N. RACINE AVENUE • CHICAGO 7, ILLINOIS

Export Dept.: 122 East 42nd Street, New York 17, N. Y.

James C. Clinefelter

James C. Clinefelter, Midwest representative for **John Royle & Sons,** died in Akron General Hospital last December 11th after a brief illness.

★ ★ ★

Mr. Clinefelter, who was sixty-four, was born in Princeton, Pennsylvania, and had made his home in Akron for the last thirty-six years. Throughout his adult life he was always closely associated with the rubber machinery business. From 1917 to 1921 he was chief engineer for Portage Rubber Company. For the next three years he was sales manager for Akron Standard Mold Company and, later held the same position with Akron Rubber Machinery Company. In 1929 he was appointed Midwest representative for John Royle & Sons and maintained offices at 2701 First National Tower, Akron.

★ ★ ★

During his career Mr. Clinefelter secured several patents covering rubber machinery and processing methods. The most important and latest of these relate to the Plastxtruder. This development is protected by three United States, two Canadian and two United Kingdom patents.

James C. Clinefelter

★ ★ ★

In recent years Mr. Clinefelter was joined in business by his two sons—Robert C. and James W.—who survive and will continue to represent John Royle & Sons.

J. Heber Parker

J. Heber Parker, chairman of the board of directors of **The Carpenter Steel Company,** Reading, Pa., died on Dec. 28th at the age of 75.

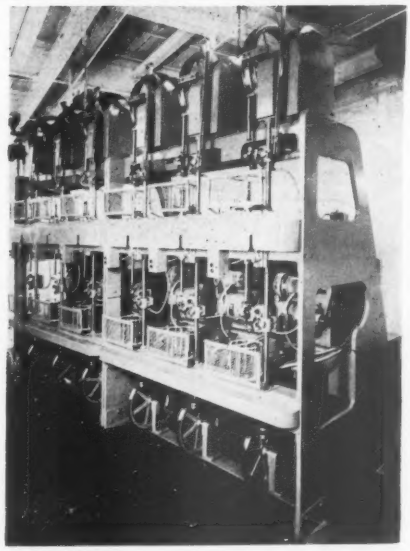
★ ★ ★

His death ended 52 years of service in the steel industry—all of them spent with Carpenter. He worked for the company during his college vacations in 1903 and 1904, and started full time in 1905 following his graduation from Cornell University.

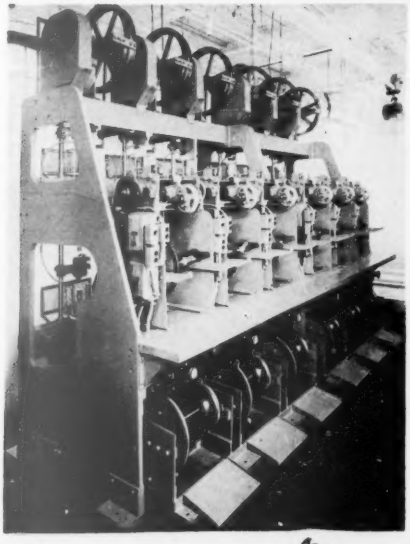
★ ★ ★

He started up the ranks from his post graduate job in the crucible melting department. He then became assistant superintendent in 1907, chief metallurgist in 1910, vice president in 1916, president in 1941, and chairman of the board of directors in 1948. He held the chairmanship until his death.

Have You Read
"STEEL WIRE IN AMERICA"?
by Kenneth B. Lewis
The price is $15.00



FRONT VIEW



REAR

3D-6-MBB TAPING MACHINE #1107

Applies double cover to 6 lines of wire simultaneously. Nominal wire range #6 to #18 B & S gauges (.162" to .040" or 4.116 MM to 1.024 MM). Standard Capstans 24" in diameter. Supply wire let-offs and torque motor driven take-ups for 24" diameter reels are at rear of machine.

EST. 1855 AIMCO INC. 1915

"American"
AIM INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

FAIRHILL AND HUNTINGDON STREETS
PHILADELPHIA 33 PENNSYLVANIA U.S.A.

Charles Haggerty

Charles Haggerty, Vice President of the New England Butt Co., a division of the Wanskuck Co., Providence, R. I., died suddenly and unexpectedly at his home on February 6th.

★ ★ ★

He started his career in the wire machinery business with New England Butt forty-five years ago and had been a familiar and well-known figure in wire circles.

Charlie began as an office boy, became a draftsman, then chief draftsman and, later, became progressively an engineer, sales engineer and in 1955, the company's Vice President. He will be greatly missed by his host of friends.

Dave Schmid to Head Medal Awards Committee Again

Tom M. Girdler, Jr., Assistant Division Manager of the Union Drawn Steel Division of Republic Steel Corp. has announced the reappointment of **David M. Schmid,** President of the Techalloy Company, as chairman of The Wire Association's Medal Award Committee for 1957, together with his entire committee who served in 1956.

★ ★ ★

These gentlemen will judge all papers eligible for Medal Awards or Honorable Mention, using the Oxford System, and the results of their efforts will be made known when the awards are presented at the Annual Convention next October.

Shattuck Joins Seymour

Announcement has been made of the appointment of **W. C. Shattuck** as Special Sales Representative of **The Seymour Manufacturing Company** of Seymour, Conn., manufacturers of non-ferrous strip, bar, rod and wire.

★ ★ ★

Mr. Shattuck comes to them with a long record of wire experience. He will make his headquarters in the New York City office, located at 122 East 42nd Street.

Named General Sales Manager

Howard S. Thrasher has been named General Sales Manager of **The Seymour Manufacturing Company,** Seymour, Conn.

★ ★ ★

The company is a large producer of nickel silver, bronze and other copper base alloys in various forms, including rods and wire.

Spring Firm Elects Executive

Announcement has been made of the election of **Louis C. Edger, Jr.** as Executive Vice President and Director of **The Universal Wire Spring Co.,** of Bedford, Ohio.

Advanced to Presidency of Spool Firm

Bruce C. Miller, who has been Vice President and General Manager of the **Mason Can Company,** East Providence, R. I., has been elected President of the firm.

★ ★ ★

At the same time it was announced that the corporate name

MASON *lightweight, non-returnable, lithographed spools for:* **INSULATED WIRE · SOLDER WIRE THERMO-COUPLE WIRE · TV LEAD-IN WIRE AUTOMOTIVE CABLE**

BEST FOR LESS! That's what 175 leading manufacturers say about Mason Spool dependability and performance.

And they help you sell, too! Mason lithography (to meet your specifications) will always assure color uniformity and sharpness of detail for *instant brand identification.*

MASON lightweight, non-returnable spools are available in 5", 6½", 8½", and 10½" head sizes. All sizes are available with 1⅜" (Dia.) barrel. The 10½" head size is also available with a 3½" (Dia.) barrel. Barrel lengths from ⅜" to 14".

Tell us about your spool requirements NOW! We'll prove Mason Spools keep costs down—sales up! Telephone East Providence 1-2810 or write:

MASONWARE COMPANY

1949 Dexter Road, E. Providence 14, R. I.,
Branch Plant — Greenville, Ohio

of the company has been changed to **The Masonware Company.** The term "Masonware" has been traditional for the concern's products, so that the change brings about a close identity of the company with its products. Masonware Company is a division of the **Fram Corporation.**

★ ★ ★

Mr. Miller also announced that **Joseph Carpenter** has been appointed Director of Graphic Arts and Advertising Manager.

★ ★ ★

Masonware products for the wire industry embrace a line of lightweight, non-returnable, lithographed spools for insulated wire, solder wire, thermocouple wire, TV lead-in wire and automotive cable.

To Head Furnace Sales for W. S. Rockwell Co.

Andrew J. Snow has been promoted to Sales Manager of the Furnace and Oven Division of **W. S. Rockwell Co.,** 200 Eliot Street, Fairfield, Conn. Mr. Snow had been in the capacity of Sales Engineer until his promotion. He was formerly Plant Engineer with the Naugatuck Footwear Division of U. S. Rubber Company and Industrial Engineer with Chase Brass and Copper. A graduate of Massachusetts Institute of Technology in 1950, Mr. Snow attained his B. S. Degree in Mechanical Engineering.

Laclede Steel Announces Promotion of Loveridge

J. M. Wilke, Vice President in Charge of Sales for **Laclede Steel Co.,** St. Louis, has announced the appointment of **Warren L. Loveridge** to the position of Sales Manager, Manufacturers' Wire, effective January 1st.

★ ★ ★

Formerly superintendent of Laclede Steel's wire mill at Alton, Ill., Mr. Loveridge has served also as regional steel products salesman in Missouri, Kansas, Nebraska and Oklahoma. Since 1953 he has been Assistant Sales Manager, Manufacturers' Wire. He has been with Laclede Steel since 1941 when he was graduated from Missouri University's School of Mines at Rolla with a degree in metallurgical engineering.

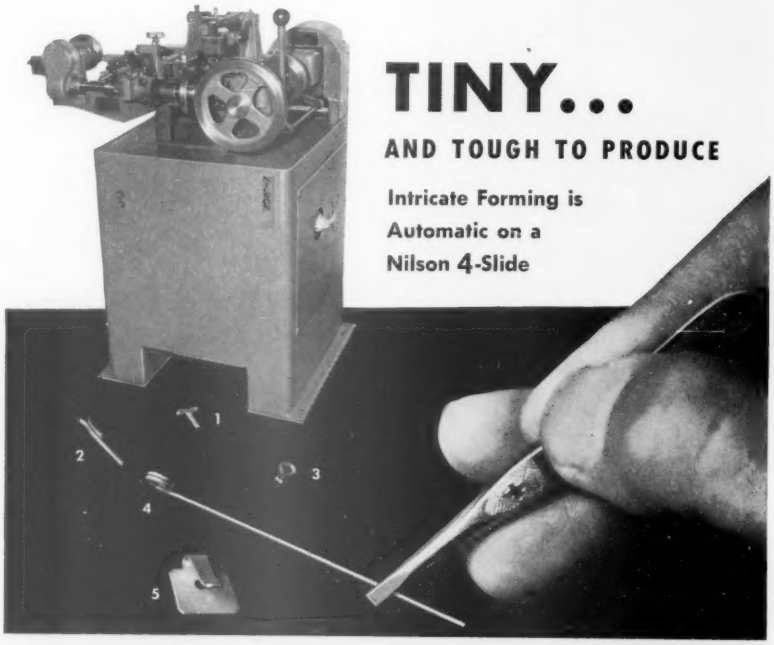
Electric Auto-Lite Elects Vice Presidents

J. Turner Moore, Jr. was elected a vice president of the **Electric Auto-Lite Company,** it was announced by **J. P. Falvey,** president, following a meeting of the board of directors in Toledo on October 31st.

Mr. Moore was formerly president of Reading Batteries, Inc. at Reading, Pa., and when that company was purchased by Auto-Lite on May 14, 1956, he became the executive liaison between Reading operations and Toledo.

★ ★ ★

He is a vice president and director of Aviation Consultants, Inc., Reading Aviation Service and Aviation Distributors and Manufacturers Assn., Philadelphia, a director of Berks County Manufacturers Assn., Berks County Trust Co. and



Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easily access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 **Mercury Switch Part** . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 **Electrical Contact** . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 **Swivel Part** . . . .025" brass wire. Heading operation includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 **Leadwire** . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 **Contact Part** . . . .010" x 3/8" wide phosphor bronze formed at 175 per minute.

A.H. NILSON MACHINE COMPANY

1516 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

Karl Liebernecht, Inc. in Reading, and the Association of American Battery Manufacturers, Akron.

★ ★ ★

Francis M. Wistert and **Robert E. Valk** have been elected vice presidents of **The Electric Auto-Lite Company,** it was announced by Auto-Lite President **James P. Falvey** following a meeting of the Company's Board of Directors.

★ ★ ★

Mr. Wistert joined Auto-Lite in 1953 after 11 years of specialization in labor relations and acting as labor relations consultant. He was named Director of Industrial Relations in 1954.

★ ★ ★

Mr. Valk, a graduate of the University of Michigan, joined Auto-Lite in February of this year as administrative assistant to the vice president in charge of manufacturing, **H. E. Hasemeyer.**

NORBIDE Abrasive Grain... *cuts die Refinishing Costs!*

If you are still using costly diamond dust for refinishing your wire drawing dies, you'll be amazed at the savings you can make by switching to NORBIDE Abrasive. Wire mills everywhere have found that this abrasive—the hardest manufactured abrasive commercially available—is ideal for ripping and semi-finishing operations.

Many of our customers order NORBIDE Grain in 100 lb. drums. Many others order and re-order ¼ lb. and ½ lb. cans. No matter what your requirements are we can fill your order promptly from stock.

For details and prices on this cost-cutting abrasive write for Form 559.

NORTON®
BORON CARBIDE
Making better products... to make your products better
NORTON COMPANY
45 New Bond Street, Worcester 6, Mass.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes.

NORBIDE® | *The hardest manufactured abrasive commercially available!*

To Head Leschen Rope Expansion

Emmett H. Mann, formerly Vice President and General Manager of the **Alloy Metal Wire Div., H. K. Porter Co.,** has been appointed to a similar post in the **Leschen Wire Rope Division.**

★ ★ ★

His first job at Leschen will be to direct an expansion program, under which the company will spend 1½ million dollars for new plant and equipment.

★ ★ ★

For the first time in 100 years, the Leschen Wire Rope Division will have its own wire drawing equipment. Many advantages are expected to accrue to customers from this arrangement, among which will be better deliveries. Added plant flexibility is also expected to be achieved.

Named Director of Marketing by Pennsalt

The appointment of **George R. Lawson** as Director of Marketing of **Pennsalt Chemicals' Industrial Division** has been announced by General Manager **Hugh C. Land.** In this newly created position, Mr. Lawson will direct the combined sales organizations of the former Sharples and Industrial Chemicals Divisions, which were recently consolidated in the formation of the Company's new Industrial Division.

Nopco Names Michael Sandor Head of New Department

The Nopco Chemical Company has announced the appointment of **Michael Sandor** as Technical Manager of Nopco's newly-formed Metal Processing Chemicals Department.

★ ★ ★

The new department, under Mr. Sandor, will be concerned with the development and sales of chemical processing compounds useful to the metal and metal working industries. At present these compounds include: rolling oils, wire and tube drawing compounds, shell mold lubricants, powder metallurgy lubricants, cutting oils, rust preventives and metal cleaning com-

pounds.

★ ★ ★

A graduate of the Newark College of Engineering with a degree in chemical engineering, Mr. Sandor has been associated with the metal processing field for the past nine years.

To Engage in Consulting Work

Having reached the age of retirement after some forty years with American Steel and Wire, **J. W. Matson,** 23 Mill Creek Rd., Branford, Conn., will be available for consulting services on plant layout, equipment and modernization.

★ ★ ★

Mr. Matson's broad experience in the manufacture of steel wire, both at the Worcester and New Haven plants, provides an excellent background for assisting those who may be in need of counsel in the construction of new mills or the modernization of old plants, all of which has been embraced in his previous responsibilities.

Vice President Named at Eutectic Welding Alloys

Joseph F. Quaas has been appointed Vice President in charge of Manufacturing and Production for **Eutectic Welding Alloys Corp., Rene D. Wasserman,** President, announced in December, following a meeting of the Board of Directors.

★ ★ ★

As a key member of Eutectic's research and production team, Mr. Quaas has played a leading role in the perfection of the many new products and manufacturing techniques developed at the Flushing headquarters of this international firm. He joined the company in 1950. He is a graduate of Newark Tech with an A.E. degree in Chemical Engineering and has a B.S. degree in Industrial Chemistry from Newark College of Engineering.

Sales Appointment Announced at Wheelabrator

F. John Pichard has been advanced to the post of Manager, Standard Equipment Sales at **Wheelabrator Corp.,** Mishawaka, Ind. The company is a manufacturer of Wheelabrator airless blast, air blast, and wet blast metal cleaning and finishing equipment, plus dust and fume control equipment. Assisting General Sales Manager **E. A. Rich,** Mr. Pichard will coordinate the application of equipment of the company's standard designs to appropriate cleaning and finishing problems, with particular attention to Wheelabrator's new line of Super Tumblast blast cleaners.

★ ★ ★

For the past 4 years, he has been District Sales Engineer on the staff of Wheelabrator's New York sales office, handling all of the company's products.

A-C Assigns Man to Hartford District

Kenneth A. Bradley has been assigned as a sales representative to the Hartford (Conn.) district of **Allis-Chalmers Industries Group.**

★ ★ ★

He joined Allis-Chalmers in 1955 and recently completed the company's general purpose equipment

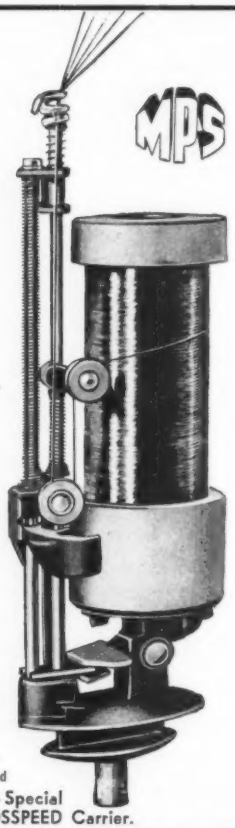
PLYMKRAFT
CABLE FILLER

Made to Your Most Exacting Specifications

Plymkraft Cable Fillers are made to fit your particular standard of manufacturing. Whether it is treated with wax, jute saturant or anthracene, Plymkraft is made to meet your moisture requirements in cables. Always uniform, made to a fine tolerance, and ready to use, Plymkraft Cable Fillers are ideal for highspeed cablers where extra strength is a must. Plymkraft's fill capacity means savings in a good-looking cable.

To keep up to date with cable filler developments, it takes only an inquiry for samples of Plymkraft. To find the quality cable filler best suited for your wire needs, write today to:

PLYMOUTH CORDAGE COMPANY
Plymouth, Massachusetts • New Orleans, Louisiana
Warwick, Virginia



Patented
2 BX - Special
MOSSPEED Carrier.

MOSSPEED BRAIDER CARRIERS

FOR BRAIDING
MULTIPLE ENDS OF FINE WIRES

A special design MOSSPEED CARRIER and BOBBIN is supplied for braiding "SHIELDED" WIRE, ETC.

Will braid multiple ends of aluminum, brass, bronze or copper wire, etc.

TWO SHEAVE-WHEELS and SPECIAL-TOP-THREADEYE on carrier, together with new type BOBBIN provides an even wire "let-off" resulting in a high quality and uniform braided shield.

Consult our engineers regarding your braiding problems.

Mossberg PRESSED STEEL Corporation

18 WEST STREET
ATTLEBORO, MASSACHUSETTS, U.S.A.

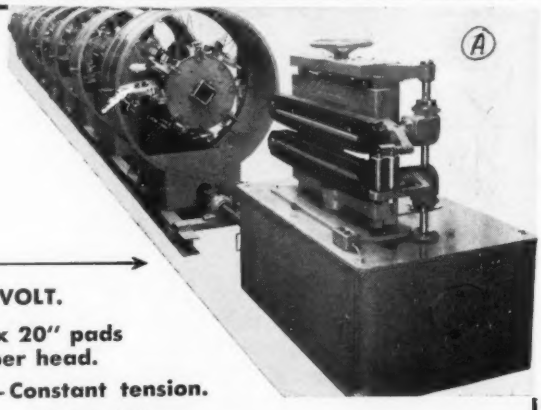
Telephone
ATTLEBORO 1-0848

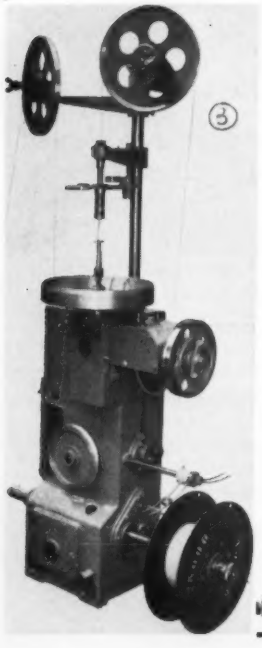
European Agent
James Day (Machinery), Ltd., 28 Maddox Street, London, W. I., England.

100

NEW...

IN PAPER LAPPING





FOR TELEPHONE

- **— High speed paper lapping.**
- **— 3,000 r.p.m.**
- **— Movable drum.**
- **— Automatic stop.**
- **— 12" pad.**
- **— Electric counter.**
- **— Central lubrication.**

FOR HI. VOLT.

- **— 8 x 20" pads per head.**
- **— Constant tension.**
- **— Extensible pad centre.**
- **— Individually braked.**
- **— Variable die.**
- **— Caterpillar haul-off.**
- **— P.I.V. drive.**
- **— Automatic stop.**

POURTIER MACHINES

153, rue Général Galliéni

ROMAINVILLE (Seine) **FRANCE**

training course. He is a graduate of the University of Wisconsin.

AS&W Appoints Sales Representative

Announcement of the appointment of **Lloyd G. Depner** as assistant manager of Cleveland District Sales has been made by **Charles H. Eisenhardt,** manager of this **American Steel & Wire** sales unit.

★ ★ ★

Mr. Depner, who started with the Division back in 1937 as "co-op" student at Fenn College, moved up into the post relinquished by **Reid C. Pierce** who retired.

★ ★ ★

In his new post he will help direct sales activities in the District which includes nearly all of northern Ohio with particular emphasis on construction materials, wire rope and merchant products.

To Sell Special Products for Universal-Cyclops

S. Allen Oviatt has been named Manager, Special Product Sales, by **Universal-Cyclops Steel Corp.,** Bridgeville, Pa.

★ ★ ★

Mr. Oviatt had previously been Manager of Turbine Blading Sales. In his new appointment, he will continue to be responsible for sales of the Turbine Blading Department, in addition to varied other special products.

★ ★ ★

During World War II, he held the rank of Lt. Colonel, United States Air Force, in charge of facilities and resources at Wright Field in Dayton, Ohio.

National-Standard Elects Directors

National-Standard Co., Niles, Mich., has elected **William F. Harrah,** one of its founders 50 years ago, a director emeritus and announced that he will continue as honorary chairman of the board of directors.

★ ★ ★

Myron F. Ratcliffe, of Chicago, president of the Miami Corporation and board chairman of the National Boulevard Bank, was elected to the directorship left vacant by the death of **William E. Schroeder.**

★ ★ ★

Other new directors elected were **James H. Ward, Jr.,** and **Thomas H. Pearce,** both of Niles. Mr. Ward came to National-Standard in 1937 as personnel director and has been vice president in charge of industrial relations since 1946. Mr. Pearce joined National-Standard in 1948 as a special projects engineer, coming from British Ropes, Ltd., Doncaster, Eng. He has been vice president of engineering and manufacturing since 1955.

New Appointments by National Electric Products

A. L. Robinson, Jr., has been named co-ordinator of operations for **National Electric Products Corporation; F. J. O'Brien** has been appointed division works manager of steel products; **K. C. Crain,** works manager of wire and cable division; and **Harry Galbraith,** manager of the Ambridge plant engineering shops.

Standardize on ACROPAK* Spools!

Only ½ the Weight!

Light Weight
Precision built
Reduced cost
Longer life
Extra strength
Dynamic balance
Greater production
Low cost reconditioning
Less maintenance
Attractive packaging

YET STRONG, TOUGH, RIGID . . *LONGER LIFE*

ACROPAK Spools will help you cut wire packaging costs because they give longer service, require less maintenance and cost less to ship. They're strong. They'll take repeated shippings and still run true on the arbor. They're machined to close tolerances. You can run them at high production speeds with fewer snags, less toe-out and minimum end breakage.

THEY CUT YOUR SPOOLING COSTS

Best proof of ACROPAK superior performance are the millions of these spools now used by the biggest names in the wire industry. We've proved it to them—let us prove it to YOU.

★ We also make a complete line of heavy-duty shop processing STEEL SPOOLS built to the same high standards of accuracy and rigidity as the famous Acropak aluminum spools.

ACROMETAL PRODUCTS INC.
616 5th Street North, Minneapolis 1, Minn.

AMERICAN IRON AND STEEL INSTITUTE
150 EAST FORTY-SECOND STREET, NEW YORK 17, N. Y.

AIS 10

Total Number of Companies Included 131

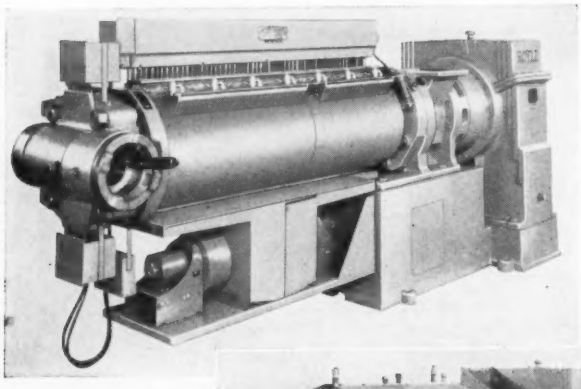
NOVEMBER - 1956
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

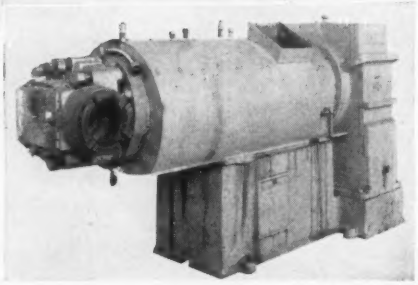
Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Items	CURRENT MONTH 1956 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1955) Percent of Total Shipments	YEAR TO DATE 1956 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1955) Percent of Total Shipments
Ingots and Steel Castings	1A	42,410	17,831	1,593	61,834	0.8	1.2	453,482	176,783	26,889	657,154	0.9	0.8
Blooms, slabs, billets, sheet bars	1B	143,417	47,868	2,881	194,166	2.6	3.1	1,516,037	510,118	28,181	2,054,336	2.7	3.3
Tube rounds	1C	87	3	18	108	-	-	8,901	2,339	107	11,347	-	-
Skelp	2	19,592	-	-	19,592	0.3	0.3	172,718	-	-	172,718	0.2	0.2
Wire rods	3	112,482	1,403	652	114,537	1.6	1.4	1,004,201	17,744	4,962	1,026,907	1.4	1.4
TOTAL SEMI-FINISHED		317,988	67,105	5,144	390,237	5.3	6.0	3,155,339	706,984	60,139	3,922,462	5.2	5.7
Bars—Hot rolled (incl. light shapes)	14	648,056	165,218	6,279	819,553	11.0	10.5	6,252,176	1,741,965	58,631	8,052,772	10.6	10.3
Bars—Reinforcing	15	249,612	-	-	249,612	3.4	2.7	2,277,739	-	-	2,277,739	3.0	2.6
Bars—Cold finished	16	108,543	23,893	6,553	138,989	1.9	2.3	1,286,143	265,567	56,057	1,607,767	2.1	2.2
Tool steel	17	1,535	8,354	-	9,889	0.1	0.1	16,201	100,993	-	117,194	0.1	0.1
TOTAL BARS AND TOOL STEEL		1,007,746	197,465	12,832	1,218,043	16.4	15.6	9,832,259	2,108,525	114,688	12,055,472	15.8	15.2
Wire—Drawn	23	238,994	4,435	2,785	246,214	3.3	3.9	2,696,579	46,560	29,354	2,772,493	3.6	3.8
Wire—Nails & staples	24	35,675	-	1	35,676	0.5	0.6	528,387	-	3	528,390	0.7	0.8
Wire—Barbed & twisted	25	2,533	-	-	2,533	-	-	71,084	-	1	71,085	0.1	0.1
Wire—Woven wire fence	26	12,294	-	-	12,294	0.2	0.2	260,234	-	-	260,234	0.3	0.4
Wire—Bale ties	27	1,292	-	-	1,292	-	-	47,985	-	-	47,985	0.1	0.1
TOTAL WIRE & WIRE PRODUCTS		290,788	4,435	2,786	298,009	4.0	4.7	3,604,269	46,560	29,358	3,680,187	4.8	5.2
Standard pipe	18	267,479	-	3	267,482	3.6	3.7	2,681,656	257	5	2,681,918	3.2	3.2
Oil country goods	19	191,600	33,947	-	225,547	3.0	3.3	1,988,723	339,512	-	2,328,235	3.1	3.0
Line pipe	20	321,783	-	-	321,783	4.3	3.6	3,045,456	39	-	3,045,495	4.0	3.6
Mechanical tubing	21	59,389	20,515	540	80,444	1.1	1.3	624,821	248,803	4,515	878,139	1.1	1.2
Pressure tubing	22	28,586	5,614	1,939	36,139	0.5	0.3	280,142	52,584	17,199	349,925	0.5	0.3
TOTAL PIPE AND TUBING		868,837	60,076	2,482	931,395	12.5	12.2	8,620,798	641,195	21,719	9,283,712	12.2	11.6
TOTAL SHIPMENTS (1956)		6,876,337	490,909	63,890	7,431,136	100.0	xxx	70,476,890	5,084,877	625,312	76,187,079	100.0	xxx
TOTAL — PRIOR YEAR (1955)		6,664,825	521,108	62,061	7,247,994	xxx	100.0	71,456,560	5,091,848	625,567	77,173,975	xxx	100.0

* Revised.



8½" Spirod extruder with side delivery head for jacketing. Up-graded from circulating type shown to the right.



EVER THINK OF UP-GRADING TO SPIROD®?

Yes, it can be—and is being—done. And Royle's traditional approach to extruder development, the retention of features that have stood the test of time, makes it possible. The one-piece cylinder with built-in hopper is replaced by a separate cast steel hopper section, a cast steel cylinder with deep grooves that create fin-like separations for the rod type heating elements and the selective evaporative cooling equipment. Head and stock screw, as usual, are designed for process requirements.

If you are operating an older type Royle extruder you should investigate up-grading to Spirod—the electrically heated extruder with high velocity evaporative cooling—for maximum efficiency in controlled operating temperatures.

Write for Bulletin # 463

JOHN ROYLE & SONS ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. — Hyde Park 2430 - 0456
Home Office — V. M. Hovey J. W. VanRiper — SHerwood 2-8262
Akron, Ohio — J. C. Clinefelter — BLackstone 3-9222
Los Angeles, Cal. — H. M. Royal, Inc. — LUdlow 9-3261
Tokyo, Japan — Okura Trading Co., Ltd. — (56) 2130 - 2149

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No 2,775,986, APPARATUS FOR THE AUTOMATIC FORMING OF A SHAPED LOOP OF WIRE FROM WIRE STOCK, patented January 1, 1957 by Eric Holroyd, Speke, Liverpool, and Desmond Lawson Jenkins, Kirkby, England, assignors to Dunlop Tire and Rubber Corporation, Buffalo, N. Y., a corporation of New York.

A loop-former is provided rotatable about its axis and comprising a back plate, a pair of adjustable, loop forming, segments each pivotally mounted at one end on the back plate and having arcuate loop forming surfaces, a third, actuating segment having an arcuate loop forming surface and slidable on the back radially with respect to the pivotally mounted segments, and links connecting the pivotally mounted segments to the actuating segment whereby radial movement of the actuating segment causes the pivoted segments to pivot on the back plate.

★ ★ ★

No. 2,776,004, WIRE FEEDING DEVICE, patented January 1, 1957 by John I. Carlson, Aurora, Ill., assignor to Carlson Tool & Machine Company, a corporation of Illinois.

There are eleven claims in this patent to an assembly including a structure for yieldingly closing a pair of wire gripping jaws to hold a wire there between; means for applying a force to a wire held in these jaws, this force being in a direction urging one jaw away from the other jaw in opposition to the closing means; means for carrying the jaws permitting the concurrent positioning of each jaw to accommodate limited transverse translation of the wire in response to the application of the force, thereby preventing opening of the jaws by the overcoming of said closing means; and means arranged to limit, when desired, the action of the carrying means and allow opening of the jaws to release the wire from therebetween.

★ ★ ★

No. 2,776,678, WIRE BENDING MACHINE FOR THE BENDING OF A WIRE OR THE LIKE, patented January 8, 1957 by Robert H. Savage, Bally, Pa., assignor to Contemporary Metals, Inc., Bally, Pa.

A pair of cooperating bending dies is provided with the die surfaces having contours varying transversely of a linear path of movement of the wire, so that portions of the wire engaged by different transverse portions of the contoured surfaces are bent with different curvatures and there is also provided a device synchronized with wire feeding means to move both dies simultaneously in a direction perpendicular to the path and also perpendicular to the movement of the one die toward the other, according to a predetermined cycle, and thereby to bend successive lengths of wire, each with a curvature varying along its length according to a predetermined pattern.

★ ★ ★

No. 2,776,764, APPARATUS FOR HANDLING COIL STRIP MATERIAL, patented January 8, 1957 by Herbert Palmleaf, Melrose Park, Ill., assignor to A. J. Gerrard & Company, Melrose Park, Ill., a corporation of Illinois.

More specifically, the invention resides in a coil strip transporting mechanism including a coil-supporting member which may be moved to position the coil selectively into a vertical or a horizontal position and is carried by an elongated arm, movable in a horizontal plane. There are seventeen claims.

★ ★ ★

No. 2,777,476, MACHINE FOR BENDING PREFORMED SINUOUS

NIEHAUS

WIRE STRANDING
ROPE CLOSING
CABLE MAKING

MACHINES

Cabling machines for steel, copper and aluminum wires, rubber and telephone strands

MASCHINENFABRIK K. A. NIEHAUS • GERMANY
DÜSSELDORF-RATH

WIRE STRIPS, patented January 15, 1957 by Harry H. Fante, Riverside, and August T. Gonia, Berwyn, Ill., assignors, by mesne assignments, to Rockwell Spring and Axle Company, Coraopolis, Pa., a corporation of Pennsylvania.

The machine is for bending at a plurality of spaced apart intervals a preformed sinuous wire strip having loop portions connected together by straight wire portions. There are twenty-one claims.

★ ★ ★

No. 2,777,477, CUTTING AND FORMING MECHANISM, patented January 15, 1957 by Jack J. Zimmerman, Riverside, Ill., assignor to Motorola, Inc., Chicago, Ill., a corporation of Illinois.

Specifically, the mechanism is for removing the excess length of a pair of contact wires extending from the ends of an electrical component and for forming such wires into a desired configuration.

★ ★ ★

No. 2,777,478, WIRE BENDING APPARATUS, patented January 15, 1957 by Roger H. Stohlquist, Rockford, Ill., assignor to Odin Corporation, Rockford, Ill., a corporation of Illinois.

An apparatus for undulating wire stock is disclosed, comprising a series of wire retaining members, a device supporting these members for movement along an endless path of travel, and a device disposed along the path of travel for successively turning the members transversely of the path of travel to undulate wire stock retained thereby.

★ ★ ★

No. 2,777,582, NECKTIE HANGER, patented January 15, 1957 by Laurence William Van Dusen, Escondido, California.

This hanger comprises a single length of wire, bent to shape.

★ ★ ★

No. 2,777,647, COIL UNREELER, patented January 15, 1957 by Thomas J. Fullerton, Palos Heights, and Robert A. Rosenblum, Chicago, Ill., assignors to Acme Steel Company, Chicago, Ill., a corporation of Illinois.

The construction includes a base having an inclined ramp extending upwardly from the end thereof whereby a coil of wire may be rolled to a position opposite a reel, this base being further provided with a cavity for positioning the coil opposite the reel, and with an inclined surface over which the lower part of the coil may be caused to slide to a position beneath a part of the reel.

★ ★ ★

No. 2,778,037, SCREW CUTTING MACHINE FOR PROGRESSIVELY CUTTING SINGLE OR MULTIPLE PITCH THREAD, patented January 22, 1957 by Pierre Edouard Renoux, Argenteuil, France, assignor to Societe Anonyme dite: Cri-Dan, Paris, France, a French company.

This is a screw thread cutting machine of the chasing cutter type. There are seven claims.

★ ★ ★

No. 2,778,059, METHODS OF AND APPARATUS FOR MAKING INSULATED MULTICONDUCTOR WIRE, patented January 22, 1957 by George E. Henning, Baltimore, and Alfred S. Windeler, Towson, Md., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York, and Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

A method is disclosed which comprises simultaneously advancing a plurality of conductors in spaced relationship, oscillating the spaced conductors rotatably as they are thus advanced, and simultaneously applying a common covering of insulating material over the advancing spaced, oscillating conductors, whereby variations in the covering of insulating material are uniformly distributed along the length of the resulting composite product.

★ ★ ★

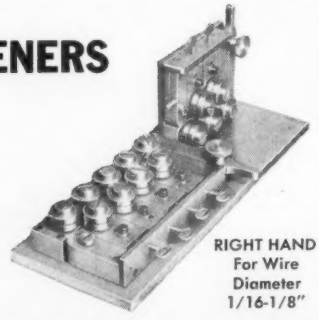
No. 2,778,152, WIRE NEWSPAPER AND BOOKHOLDER, patented January 22, 1957 by Theodore Russell, Naugatuck, Conn.

A tripod structure is provided composed of bent wire lengths.

★ ★ ★

No. 2,778,385, APPARATUS AND METHOD FOR FORMING SINUOUS WIRE STRUCTURAL AND HEAT

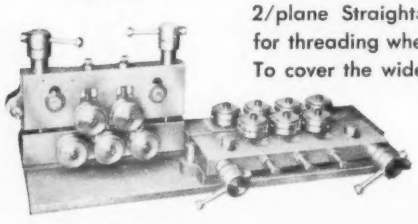
Sjogren 2 PLANE ROLL STRAIGHTENERS



RIGHT HAND
For Wire
Diameter
1/16-1/8"

Sjogren Two Plane Roll Straighteners are fully ball bearing for heavy production duty. They are designed to accommodate all sizes and grades of round or shaped wire whether it be high carbon, low carbon or copper, as well as the many alloys, from .010" to .375". Once set for the job at hand Sjogren 2/plane Straighteners may be opened and closed for threading when making coil changes without effecting the adjustment of the setting. To cover the wide range of wire diameters there are several size groups manufactured with either left or right hand direction. Each is individually produced to exact specifications for the grade, size and type of wire to be processed. Sjogren Two Plane Roll Straighteners do their duty each day, every day in the year.

LEFT HAND
For Wire Diameter
3/16-3/8"



Used by Wire Men Who Want the Best!

SINCE S&S 1927

WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • CAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

SJOGREN TOOL AND MACHINE CO., INC.

Tools for The Wire Industries

14 SWORD STREET, AUBURN, MASSACHUSETTS

EXCHANGE ELEMENTS, patented January 22, 1957 by John R. Gier, Jr., Cleveland, Ohio.

Apparatus and method claims are included in the seventeen claims of the patent. The method comprises weakening straight wire to facilitate bending at regularly spaced intervals along its length, and gathering the wire into sinuous form by feeding the straight wire positively against abutments moving in the direction of feed of the straight wire while maintaining the linear rate of motion of the abutments less than the rate of feed of the straight wire.

★ ★ ★

No. 2,778,386, GRID WINDING MACHINE, patented January 22, 1957 by James B. Lindsay, Milburn, N. J., assignor to Kahle Engineering Company, North Bergen, N. J., a co-partnership.

A drive means is disclosed for a grid winding machine having a rotating side wire feeding spindle and a rotating draw sleeve spaced from and mounted concentrically with the spindle to draw side wires through the spindle as the draw sleeve is moved by a lead screw and having grid forming tools mounted between the spindle and the draw sleeve.

★ ★ ★

No. 2,778,591, WIRE PALLET, patented January 22, 1957 by Raymond W. Chalmers, deceased, late of Detroit, Mich., by Elsie M. Chalmers, executrix, Detroit, Mich.

The pallet includes a number of helical wire springs adapted for limited rotation responsive to slidable movement of pick-up arms beneath the pallet.

★ ★ ★

No. 2,778,870, COMPOSITE CABLE FOR CONDUCTING ELECTRICITY, patented January 22, 1957 by Vincent B. Nolan, Miami, Fla., assignor to Bethea Company, Inc., a corporation of Alabama.

This cable includes a high tensile strength core wire having relatively shallow and rounded serrations on the outer surface thereof, and a number of electrically conductive wires stranded around the core wire with the inner surface of the conductive wires in frictional contact with the serrations on the outer surface of the core wire.

★ ★ ★

No. 2,779,149, NON-ROTATING WIRE ROPES, patented January 29, 1957 by Heri Schuller, Limbach, near Homburg, Saar Territory, Germany, assignor by mesne assignments, to George H. Rother, South Plainfield, N. J.

A multi-layer spiral rope is disclosed comprising a core, a number of intermediate wire layers each comprising a number of strands, the strands of all intermediate layers being laid with the same direction of rotation and having an equal pitch and the direction of the twist of the wires of the strands of one intermediate layer being opposite to the direction of the twist of the wires of the strands of an adjacent intermediate layer, and a covering layer comprising a number of wire strands upon these intermediate layers and having a relative sense of rotation opposite to the intermediate layers.

No. 2,779,384, WIRE FEEDING AND STRAIGHTENING APPARATUS, patented January 29, 1957 by John Peter Knauth, Skaneateles, and Kenneth R. Lang, Liverpool, N. Y., assignors to Syracuse Special Machine Company, Inc., Syracuse, N. Y., a corporation of New York.

The construction of this apparatus, includes a pair of brackets each supporting a roller and which brackets being slidably mounted in a rotatable member whereby rotation of the latter causes the brackets to tend to move apart bringing the rollers into close engagement with the wire, rotation of the rotatable member also causing the rollers to travel about the surface of the wire to move it in the axial direction.

★ ★ ★

No. 2,779,551, CRIB FOR WIRE COIL FORMED ON STATIONARY COILING BLOCK, patented January 29, 1957 by Ferdinand J. Penitz, Cleveland, Ohio, assignor to United States Steel Corporation, a corporation of New Jersey.

There are seventeen claims. The construction includes means mounting at least two of four standards for movement out of their circumferentially spaced arrangement with respect to a support to permit removal and replacement of a coil handling stem on the support by a horizontal movement on the stem with respect to the support.

★ ★ ★

No. 2,779,600, WIRE PUZZLE,

The NEWEST!

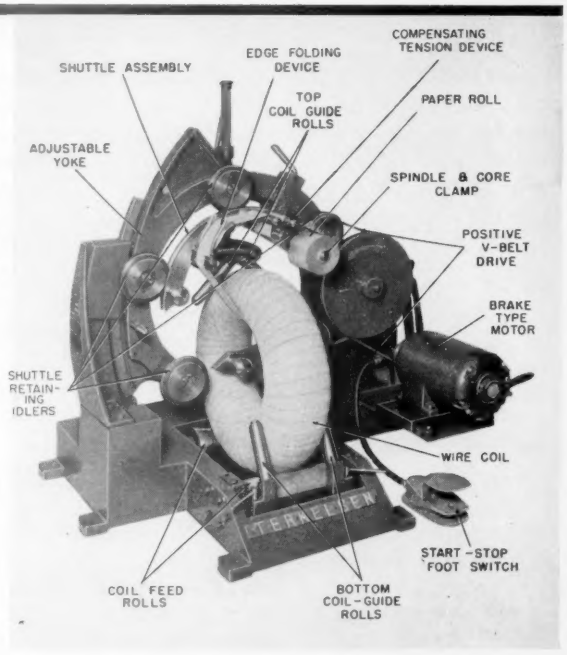
TERKELSEN'S Model 4-57

WRAPPING MACHINE

Wraps wire coils 17" to 30" outside diameter, minimum inside diameter of 10", and with a cross-sectional diameter of up to 10". Larger coil capacities available on order.

FEATURES:

- POSITIVE V-BELT DRIVE.
- HIGH-SPEED PRODUCTION *unequalled by any machine.*
- TIGHT & UNIFORM WRAP *of every coil.*
- BALL-BEARINGS THROUGHOUT.



For additional information on the Model 4-57 or any of our other 20 standard spiral wrapping machines (for either coils or straight lengths), write to:

TERKELSEN *Machine Company*

Terkelsen Building — 326 A Street, Boston 10, Massachusetts

World's Largest Manufacturer of Spiral Wrapping Machines

Member WAS

patented January 29, 1957 by Peter A. Hagen, Opheim, Mont.

The puzzle comprises a continuous piece of wire formed into a number of intricate shapes.

Novel Packaging for Wire Rope Clips

A new concept in industrial packaging is now being utilized for the stocking and shipment of ACCO Clips, a drop forged wire rope clip recently introduced to the trade by the Wire Rope Divisions, **American Chain & Cable Co., Inc.**, Wilkes-Barre, Pa.

★ ★ ★

Emerson H. Todd, sales manager, states that "These handy and easy-to-use packages are designed for quick handling and convenient storing. The packaging was designed to replace the usual method of stocking wire rope clips—in burlap bags, storage bins, and kegs.

★ ★ ★

The strong and lightweight paper cartons are secured with steel strapping and serve both as a storage and shipping container. A two-color printed label is utilized for the identification of the contents.

★ ★ ★

The containers vary in size to fit the physical measurements of the clips which are available in 14 sizes to fit wire ropes of ⅛ inch to 1¼ inch O.D. Clips are boxed in lots of 100 for the smallest size to 10 for the largest size units.

COPPER STATISTICS

COPPER - Consumption of refined copper in the United States, October-November 1956, in short tons

	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
October:						
Cathodes	500	7,816	(3)	76	(3)	8,392
Wire bars	72,595	5,992	(3)	-----	(3)	78,587
Ingots and ingot bars	1,656	6,671	(3)	152	(3)	8,479
Cakes and slabs	-----	14,401	(3)	-----	(3)	14,401
Billets	-----	13,736	(3)	-----	(3)	13,736
Other	-----	-----	(3)	31	(3)	31
Total	74,751	48,616	(4)	259	(4)	4/126,626
November:						
Cathodes	613	7,367	(3)	76	(3)	8,056
Wire bars	63,347	5,501	(3)	-----	(3)	68,848
Ingots and ingot bars	1,609	6,239	(3)	160	(3)	8,008
Cakes and slabs	-----	12,670	(3)	2	(3)	12,672
Billets	-----	12,566	(3)	-----	(3)	12,566
Other	-----	-----	(3)	36	(3)	36
Total	65,569	44,343	(4)	274	(4)	4/113,186

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 3,000 tons included in total.

CAMDEN WIRE CO., INC.

Wire Fabricators

Producers of Quality Fine Wire Copper Conductors

EXTRA FLEXIBLE CONDUCTOR STRANDED OR BRAIDED

MULTIPLE ENDS OF SIZES .008 to .002

BARE · TIN or LEAD COATED · SILVER PLATED

Special Heavy Tinned Conductors for Hook-up Wire

40 MASONIC AVENUE • CAMDEN, NEW YORK

Coast Bed Spring Firm Has Developed Sizable Business

Jack and **Bill Delamar** have been making bedsprings successfully for the last 19 years in Los Angeles. The two enterprising brothers noted the increasing public interest in box spring construction in 1937 and began operating a small spring assembly shop, now known as the **Delamar Bed Spring Co.** This small shop placed them among the few firms on the west coast that were producing springs for the then newest idea in comfort.

★ ★ ★

Jack (left) and Bill Delamar, owners of Delamar Bed Spring Co., standing in front of a number of their springs. * * * * * * * *

Primary production in 1937 consisted of buying prefabricated parts of the spring units and assembling them for the furniture trade. As the demand grew, they invested their profits and purchased their own wire coiling equipment and began integrated production for manufacturers.

★ ★ ★

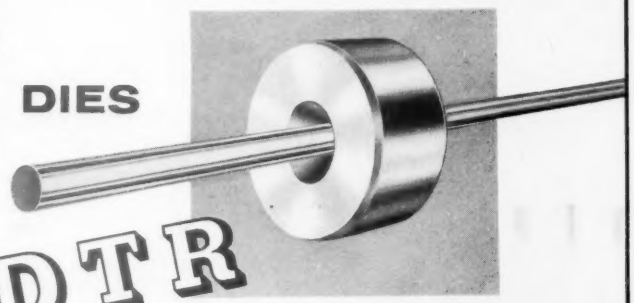
From a weekly production figure of 200 completed springs in 1947, they have grown to a present capacity of more than 5,000 completed spring sets weekly. Currently, more than 60 employees are producing spring units for approximately 125 mattress manufacturers.

★ ★ ★

From the coils of Silver Star Spring Wire to a finished spring

FINISH

YOUR WIRE DIES WITH DTR



QUALITY CONTROLLED DIAMOND COMPOUND

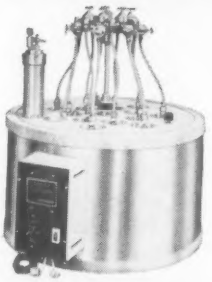
Maximum Diamond Concentration
(exceeds government specification MIL-C-16195)

- Accurately Graded
- Permanently Suspended
- Uniformly Dispersed
- Color Coded

Get the story on how good diamond powders and compounds are made; where, when and how they should be used, and how a drop of DTR's remarkable liquid extender brings dead, used-up diamond compound back to life.

DIAMOND TOOL RESEARCH CO., Inc. 380 Second Avenue New York 10, New York GRamercy 5-3530

For ageing tests of elastomeric insulating materials . . . free from contamination



SCOTT TESTER* MODEL LGP

*Trademark

in conformity with ASTM Specs.

Model LGP Scott Tester* is an aluminun block Heating Bath designed for pressure ageing of a number of specimens of rubber or plastics simultaneously, all positively isolated against contamination or exchange between specimens. Accommodates 14 separate cylinders for testing at elevated temperatures in pressured air or oxygen per ASTM Specifications D572-53 and D454-53. Also available, Model LG for non-pressure tests up to 550°F and Model LGH up to 1000°F.

LITERATURE UPON REQUEST

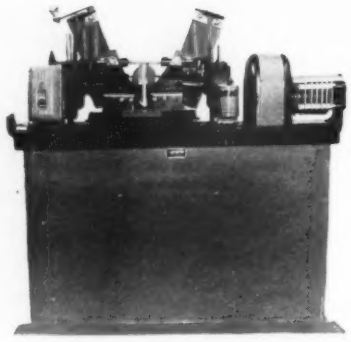
Your testing problem is our business. State your problem and let our 57 years experience assist.

SCOTT TESTERS, INC. 55 Blackstone St. Providence, R. I.

Scott Testers — Standard of the World

PROFITABLE STRIPPING

OF YOUR SCRAP AND REJECTED WIRE & CABLE IS GUARANTEED WHEN YOU HAVE THE RIGHT MACHINE ON THE JOB.



Many of our machines have been in service up to 10 years. Our later MODEL "526" (pictured), with a capacity of 5/16" to 6", is now the accepted leader in the scrap and salvage trade. Strips short or long lengths, or off the reel.

For FAST and CLEAN CUTTING, in most cases actually taking the cable apart. No other machine can match the patented cutting action of the "526".

SAVES ALL RUBBER, PLASTIC, LEAD, COPPER AND ALUMINUM

Several models available for small or special work and plastic tubing.

Detailed information available—ask for it

HOWARD A. BURDWOOD, INC.

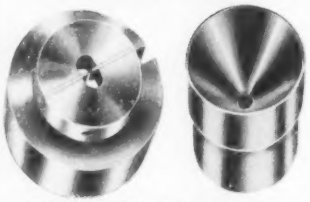
P. O. BOX 2115, 120 THADEUS ST., SO. PORTLAND, MAINE

INSULATING DIES AND NOZZLES

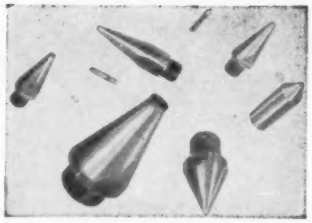
for EXTRA-HIGH ELECTRIC WIRE PRODUCTION

CARBIDE AND STEEL

Highest Quality Workmanship and Materials. Standard Types and Special.



STEEL DIES—ALL SHAPES.



CARBIDE EXTRUSION NOZZLES OR TIPS FOR ALL MACHINES.

BRIDGEPORT CARBIDE NOZZLES have phenomenally long life, will lower operating costs and reduce wire breakage.

BRIDGEPORT STEEL DIES are made in Round, Figure 8, Serrated, Tracer and other Special Shapes to your specifications. A newly designed Tru-Rip Die Assembly can be taken apart, cleaned, blades changed and reassembled quickly and easily. Made for 2 and 3 conductor wires to be coated in extrusion machines.

Write for folder or phone for information

WIRE TOOL DIVISION

BRIDGEPORT JIG BORING COMPANY

303 STRATFORD AVE., BRIDGEPORT, CONN. **TEL.: FOREST 7-8473**

LEADER IN HIGH PRODUCTION EXTRUSION TOOLS FOR ELECTRIC WIRE

assembly takes less than five minutes in Delamar's modern plant. The operation consumes some 300,000 pounds of wire monthly, a majority of which is supplied by **Bethlehem Pacific Coast Steel Corporation** from its Los Angeles Wire Mill. A Wells crimping machine produces component parts of the assembly which are channeled to the assembly line and then by conveyor through a paint booth and out into the framing department. From the framing department they are shipped to the mattress manufacturers where they are upholstered and readied for the retail customer.

★ ★ ★

The Delamars attribute the improved construction to better production equipment and the better grades of steel that are now available. The continually improved quality of wire used provides a minimum amount of breakdown time in the high speed automatic coiling machines.

★ ★ ★

The company operates a subsidiary factory in Seattle to service the Pacific Northwest, which supplies approximately 95% of the entire needs of that area in springs for box spring units.

Jacobson Announces New Conduit Locknuts

Harvey Jacobson, president of the **Jacobson Nut Mfg. Corp.,** announces that their plant in Kenilworth, N. J., is currently manufacturing cold formed, high-tensile, steel conduit locknuts, which are available in all standard locknut sizes up to and including 6". These nuts are cadmium plated and UL Approved.

★ ★ ★

The new Jacobson locknuts have a much higher tensile strength than standard, cast commercial locknuts. Production of the new locknut is highly automated, resulting in high quality and low cost.

★ ★ ★

For further information, engineering assistance and samples, inquiries should be addressed to the Jacobson Nut Mfg. Corp., Box 177, Kenilworth, N. J.

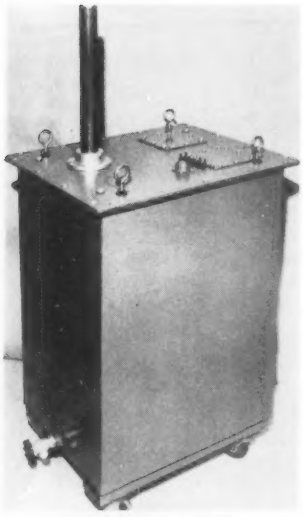
100 KV DC Test Set Available For Overpotential Testing

A non-destructive, very high potential unit is now available for insulation testing of samples, or full reel tank testing. The unit offers a preferred method of checking the insulation of cables and it meets new IPCEA standards as well as MIL, JAN and ASTM specifications. Some of the outstanding features of the unit are:

0-100 KV voltage output
Adequate capacity for rapidly charging full reels
Automatic Output shorting
External interlock provision
KV meter and current meter for determining leakage resistance
Overcurrent trip-out to deenergize HV
Dual range meters

★ ★ ★

The unit incorporates all the safety and convenience features of more expensive sets. Further information can be obtained from **Peschel Electronics, Inc.**, 19 Garden Street, New Rochelle, N. Y.



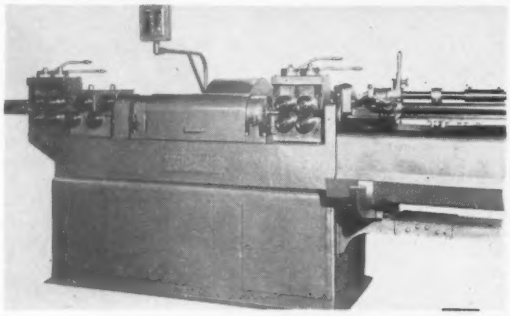
100 KV DC Test Set

To Furnish Rod Mill Lube System

The Dravo Corp., Pittsburgh, has been awarded a contract by The **Blaw-Knox Co.** for four Dravo-DeLaval mill lubrication systems, to be installed on the rod mill at **Keystone Steel & Wire Co.**, Peoria, Ill.

New, Fast STRAIGHTENER and CUTTER

Handles 1/4" to 1/2" Wire—3" to 50' Lengths



Model 9A, pictured, is for ferrous or non-ferrous heavy wires. Other models accommodate smaller stock.

The 9A feed and speed can be varied from 70 to 200 feet per minute.

OTHER FEATURES

Wichita low-inertia air tube clutch and air brake makes quick, clean and positive cut-off possible. Electric actuated trip. Motor control switch on swinging pendant. Tool storage in base. Bundling brackets. End pull-through device. Two 4-roll feed housings for positive feeding. Many other refinements—all features of the 9A and other models for finer wires.

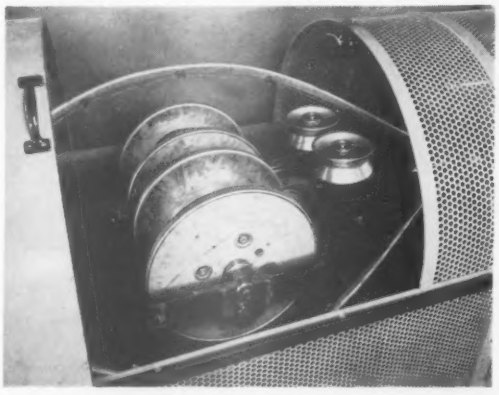
ALSO MANUFACTURERS OF WIRE REELS AND HI-HATS.

Send your requirements and ask for details.

The Geo. C. PATTERSON MACHINE Company

3409 Trumbull Street • Cleveland 15, Ohio

TWO-WIRE DOUBLE TWIST CONSTANT TENSION TWISTING MACHINE



Designed and built for the uniform twisting of finer wires as small as No. 26 gage.

Tension control is combined with over run prevention and slow acceleration to permit the use of large reels and long lengths of small diameter wires.

Speeds up to 2280 lays per minute.

Reel sizes up to 24 inches diameter and 9¼ inches overall width or 19 inches diameter and 13½ inches overall width.

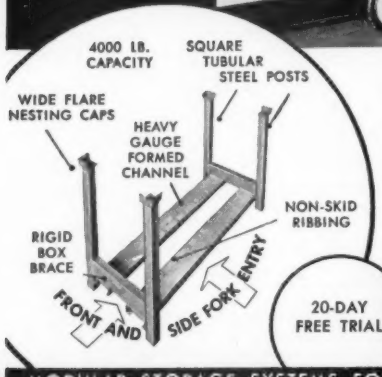
These machines are very efficient high speed units.

For information on this efficient machine, write:

THE EDMANDS CO. **860 WELLINGTON AVE., CRANSTON 10, R. I.**

Tel. STuart 1-2205

JARKE
PORTABLE
WIRE
COIL
RACKS



Solve Wire Coil Storage Problems

Makes handling and storing of unwieldy wire coils a simple one-man operation. Improves plant housekeeping, saves space, provides positive inventory control. Front and side fork entry permits closer stacking and greater maneuverability in narrow aisles. Saves time, labor, cuts costs. Standard and special sizes.

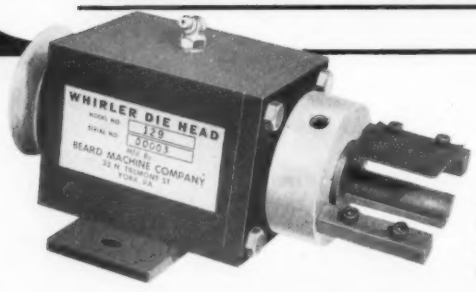
20-DAY FREE TRIAL

JARKE MANUFACTURING COMPANY

Send for Details
5407 Broadway
Chicago 40, Ill.

MODULAR STORAGE SYSTEMS FOR METAL INDUSTRY • STEELMOBILE

CUT COSTS OF APPLYING ASBESTOS INSULATION



Beard Whirler Die Head model No. 129 with 9/16" die holder . . . 3/8" and 1/4" holders also available.

NEW BEARD WHIRLER DIE HEAD AND DIES HANDLE OVER 100 DIFFERENT WIRE SIZES. IMMEDIATELY AVAILABLE!

Want uniform wire insulation of highest dependability . . . at lowest possible cost? Use modern Beard Whirler Heads and Dies in your asbestos insulating system. Beard dies are immediately available to accommodate more than 100 wire sizes. Can be used as wet whirlers and polishing heads, too. If you want flexibility, simplicity of operation, and big savings of time and labor — write for detailed data sheets and full information NOW!

BEARD MACHINE COMPANY
32 N. TREMONT STREET • YORK, PENNSYLVANIA

Chronology of Cobalt

(*Continued from page 303*)

estimated at 670 short tons this year. (See 1939.)

1954

National Lead's subsidiary, Cobalt and Nickel Reduction Company, Fredericks-town, Missouri, becomes third plant using Chemical Construction Company's cobalt-leaching process.

1954

Cobalt process patent granted to F. A. Schaufelberger and P. T. McGauley, U. S. 2,694,006, for work started by Chemical Construction Company in 1940.

1955

Cobalt world production nears 14,000 short tons. U. S. and Canadian production has increased to 3,000 short tons from less than 1,500 tons in 1952.

1955

Union Minière du Haut Katanga produced over 8,500 short tons of cobalt. Howe Sound Co. produced some 800 short tons.

1955

International Nickel Company reports a recovery of 818 tons of cobalt in its operations.

1956

H. W. Davis in Mineral Facts and Problems, Bulletin 556, Bureau of Mines, 1956, writes: "Cobalt reserves are sufficient to sustain new and increased uses. The U. S., the largest consumer of cobalt, may become the second largest producer in 1956. The potential world production of cobalt will greatly exceed world requirements, etc."

1956

January—Bureau of Mines (R.I. 5175) announces first making of cobalt of 99.99 per cent purity.

1956

January—Radiaton-sensitive glass containing cobalt announced. This is suggested for the measurement of routine doses of high-energy radiation (10^3 to 10^7 rep). Cobalt glass is also used to read the dose of gamma radiation on sterilizing drugs. Cobalt glass needles are being developed to indicate cancer treatment dose.

1956

April — Cobalt-chromium-carbon composites are announced. (American Society for Testing Materials Bulletin, page 62.) A water-lubricated bearing material capable of performing in water at temperatures of 200 F and over.

1956

June—Westinghouse Electric announces a new cobalt alloy "Nivco," for steam turbines, to operate at 1200 F.

1956

July—Union Minière du Haut Katanga, world's largest cobalt producer, celebrates 50th Anniversary.

1957

January—A Belgian Corporation, Societé Anonyme Centre d'Information

du Cobalt, established in Brussels. It is represented in the U. S. by Battelle Memorial Institute.

The purpose of the Cobalt Information Center is to give widespread distribution to technical information on cobalt, to provide adequate aid to users, and to encourage research in the improvement of old uses and the development of new uses for cobalt.

Directors to Meet in Hamilton

The Semi-Annual Meeting of the Board of Directors of **The Wire Association** will be held in conjunction with the Regional Meeting scheduled for Hamilton, Ontario, Canada, Monday, May 13, 1957, at the Royal Connaught Hotel. All directors are urged to be present to act upon business to come before the Board.

Scovill Further Decentralizes

Scovill Manufacturing Co., oldest and one of the five largest brass producers, has carried its decentralization program further by making the four divisions at Waterbury more independent.

★ ★ ★

These are the Mills Div., producer of brass alloy sheet, strip, wire, rod, tube and aluminum sheet; the General Manufacturing Div., makers of lawn watering equipment, hose couplings, cosmetic containers, and operators of a large contract manufacturing business; the Forging and Screw Machine Div., in the contract manufacturing field; and the Closure Div., makers of snap fasteners, zippers, tack buttons, burrs and rivets for garments.

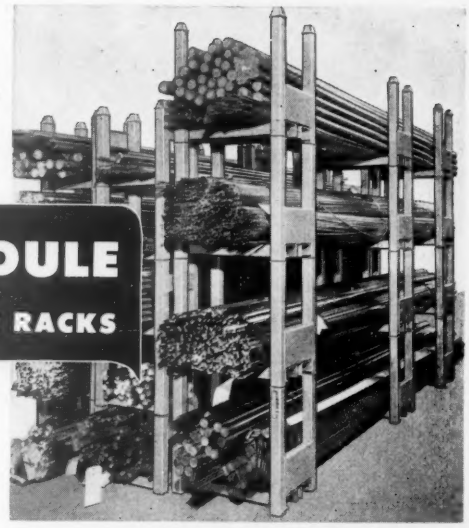
★ ★ ★

The change in Scovill's organization coincides with the retirement of **Arthur P. Hickcox,** veteran Scovill vice-president and director. His previous responsibility as General Manager of the Waterbury Divisions has been divided among four newly appointed general managers — **Chauncey P. Goss,** Mills Div., **Henry W. Wild,** General Manufacturing Div., **Willis H. Machin,** Forging and Screw Machine Div. and **Paul E. Fenton,** Closure Div.

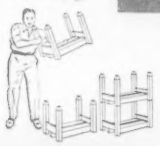
★ ★ ★

Store Your Bar, Rod and Pipe Stock Faster, Easier Neater, Safer

USE JARKE
MINI-MODULE
PREFABRICATED
STOCK STORAGE RACKS



Lightweight
Set Up or
Take Down
In Seconds
No Bolts
No Tools
No Fittings



JARKE
MANUFACTURING COMPANY
5407 N. Broadway
Chicago 40, Illinois

Jarke "Mini-Modules" provide the best, most flexible system for storing bar, rod and pipe stock. You can quickly set up, expand or decrease storage capacity to suit requirements. Saves space, improves stock appearance, simplifies inventory control, cuts costs. Sturdy steel construction with special "nesting" caps insures rigid, safe tiering. Four standard models.

20-DAY FREE TRIAL . . . SEND FOR DETAILS

MODULAR STORAGE SYSTEMS FOR METAL INDUSTRY • STEELMOBILE

AT YOUR SERVICE

SPECIALIZED ENGINEERING
SPECIALIZED EXPERIENCE
SPECIALIZED MACHINERY
FOR
TWISTING • STRANDING • BUNCHING
Continuous Tension Control
For Precision-Quality

HASKELL-DAWES
MACHINE CO., INC.
2231 E. Ontario Street
Philadelphia 34, Pa.

For Superior Results Use

ROME

WIRE DRAWING COMPOUNDS

for

STEEL, COPPER, BRASS, ALUMINUM, ETC.

These new compounds for both WET AND DRY WIRE DRAWING have been under development and field test for 2 years and are showing superior results in leading wire mills, with savings in wire production—and in *original cost.*

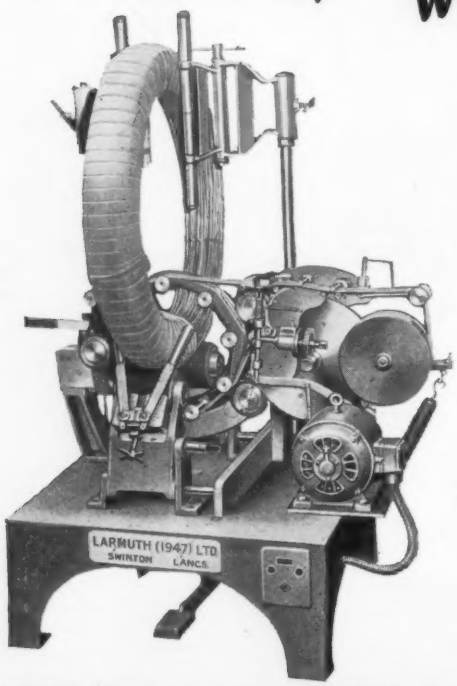
Write or telephone for full information

ROME SOAP MANUFACTURING COMPANY

SIXTH STREET • Tel.: Rome 139 • ROME, N. Y.

— MANUFACTURERS OF INDUSTRIAL SOAPS SINCE 1896 —

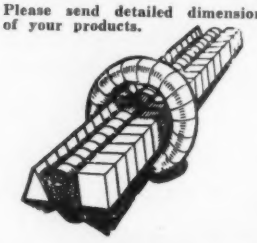
LARMUTH *Spiral Wrapping* **MACHINES**



are built to finest British engineering standards and are in use throughout the world for spiral wrapping of Motor Tyres, coils of Wire, Strip, etc., from 3" bore upwards. Also straight length Tubes, Bars, Rods, etc.

"BOUND" to get there safely.

Please send detailed dimensions of your products.



LARMUTH *of England*

U.S.A. Agents: Machinery & Machine Supplies Co., Inc.
305 East 47th St.,
New York 17, N. Y.
Telephone: Plaza 8-0744-5-6-7

LARMUTH (1947) LTD., EAST LANCASHIRE ROAD, SWINTON, MANCHESTER, ENGLAND.
Telephone: Swinton 1015

This change in Scovill's organization follows its policy of decentralization, creating a total of eight operating divisions, the others being the Hamilton Beach Co., Racine, Wis.; A. Schrader's Son, with plants in Brooklyn, N. Y., Toronto, Canada, Birmingham and Cannock, England, and Jacarei, Brazil; Oakville Co., with plants in Oakville, Conn., Philadelphia, Pa. and St. Mary's, Ont.; and Waterville Div., Waterville, Conn.

★ ★ ★

Scovill has completed a financing program and funds from this and company reserves will be used for capital improvements totalling about $25,000,000 during the next two years. The largest single expenditure will be for a new tube mill to be erected at New Milford, Conn., in the spring.

Effects of Cold Work and Annealing Temperatures on the Grain Size and Hardness of Various Types of Copper Wire

(*Continued from page* 296)

to the incomplete removal of the foreign material in and on the cathode particles prior to briquetting, Type B copper after extrusion has a relatively large amount of segregated inclusion material present in the form of "stringers". Grain growth starts at a somewhat higher temperature than it does in Type A copper, and proceeds nonuniformly when it does take place at the higher temperatures (see Fig. 1). In the regions where the concentration of foreign material (the stringers) is high, the grain size remains quite small even at elevated temperatures (900 degrees C), while the rest of the mass, which is low in foreign material, develops a large grain size at low temperatures (600 degrees C or less). The maximum grain size developed is somewhat smaller than that of Type A at the same temperature because, as postulated in concepts #5 and 6, the stringers are closer together (0.1 to 0.6 millimeters apart) than the grain diameter of Type A copper at a corresponding temperature.

★ ★ ★

Tough pitch electrolytic copper has about the same metallic impurity content as the two oxygen-free types of copper plus an appreciable amount of oxygen. This

oxygen is present as copper oxide and occurs as finely dispersed oxide particles. In tough pitch copper some regions usually have higher oxide content than others—a condition which results from a non-uniform distribution of oxides in the original wire bar. The areas high in oxide correspond to the "set surface" of the wire bar. Tough pitch, containing a relatively large amount of evenly dispersed copper oxide (as compared to the amount and dispersion of the foreign material in Type B copper), must be raised to a high temperature before the rapid increase in the rate of grain growth occurs (see concepts #2 and 3). The resultant maximum grain size is much larger than that of Type A at the same temperature as indicated in concept #4 (see Fig. 1). The non-uniform distribution of the oxides in tough pitch copper gives rise to a non-uniform structure, which is almost eliminated at a temperature of 850 degrees C. The non-uniformity is more readily eliminated in the tough pitch copper than in the Type B because there is not as great a spread in the concentration of the foreign material in the former.

★ ★ ★

The explanation for the lowering of the temperature at which the rapid increase in the rate of grain growth takes place with increasing degrees of cold work (see Table III) is seemingly straight-forward. It is a well-known fact that the recrystallization temperature of a cold worked material is lowered with increases in the degree of cold work, so it is logical to expect the temperature at which a rapid increase in the rate of grain growth occurs to be similarly lowered.

★ ★ ★

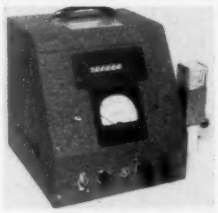
The secondary softening, occurring at the temperature at which a rapid increase in the rate of grain growth occurs, may be explained on the basis that the grains (at this point) are of sufficient size so that many of the discontinuities or dislocations in the material presented by a multitude of randomly oriented grains are removed. This lessens the resistance to deformation and results in a lower observed hardness reading.

NON-DESTRUCTIVE DIELECTRIC TESTING

IS AT ITS BEST WITH PESCHEL EQUIPMENT

SENSITIVE HI-POT TESTER
Model H 5, AC/DC

An improved line that automatically deenergize high voltage when leakage current reaches 5 microamps. Models available from 2 KV to 120 KV. Will show leakage that less sensitive instruments cannot detect.



PINHOLE DETECTOR, COUNTER
Model P-1

Indicates and counts pinholes in insulation at speeds up to 600 fpm. For continuous production use on single or multiple conductor wire. Will not harm the finest wire. Comes in several voltage ranges.

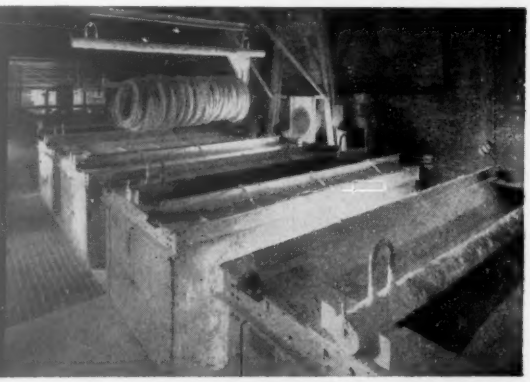
A COMPLETE LINE OF DIELECTRIC TESTERS FOR WIRE.
SPECIAL TESTERS WILL BE BUILT TO ORDER.

Write for Catalogs or Telephone for Information

PESCHEL ELECTRONICS, INC.

13 GARDEN STREET
NEW ROCHELLE, N. Y.
Tel.: NE 6-3342

carl mayer
HI-SPEED
REGISTERED
ROD BAKERS



Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

Here are just a few of our many satisfied customers:

American Steel & Wire Co.
Atlas Steel Co.
Colorado Fuel & Iron Corp.
Crucible Steel Co. of America
Driver-Harris Co.
B. Greening Wire Co., Ltd.
Indiana Steel & Wire Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
Sheffield Steel Div., Armco Steel Corp.
Steel Company of Canada

Write for Bulletin No. 350

Patent Nos.
U. S. A. 2,296,361
2,323,828
2,235,559
Canada 396,144
401,589

THE carl mayer CORP.
3030 EUCLID AVE., CLEVELAND 15, OHIO

OTHER PRODUCTS: Core Ovens • Mold Ovens • Welding Rod Ovens • Heat Treating Ovens & Furnaces • Special Processing Equipment and Accessories.

CUT
Die Room
COSTS
50%
with the New type "M"

DYKREX
"IT CORRECTS THE DIE"

automatic Polishing Machine

Double your finished Tungsten Carbide Die production

•

Save ½ labor costs—

•

The new automatic polisher with the Time Switch—

•

It is completely assembled—just plug it in!

ROOS TOOL & MFG. DIVISION
Dykrex Corporation of America
manufacturers of
Wire Die Finishing Machinery

33 Bloomfield Avenue
Newark 4, N. J.

Western Union
Teletype Service
QAB-WUX—Montclair, N. J.

The Standard of the Wire Industry

Automatic Control of Furnaces Used in Wire Processing

(*Continued from page* 292)

in general, especially where galvanometer instruments with chopper bar mechanism are applied. The regulator has therefore to be adjusted to a mediocre temperature differential and for not too frequent sequence of control actions. Introduction of a neutral zone will reduce the number of contacts made (Fig. 7). Electronic controllers having less or no contacts are better off in this respect, and allow also better accuracy to be achieved due to their quicker reaction to temperature changes.

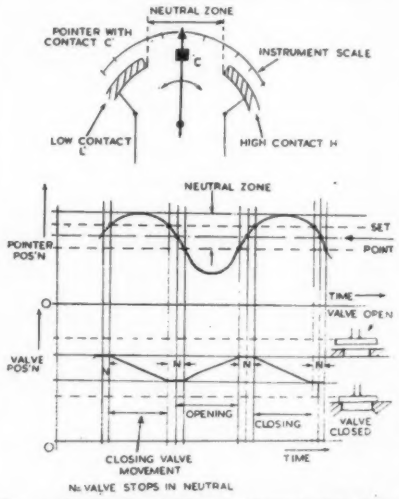


Fig. 7—Single Speed Floating Control with Neutral Zone

The Regulating Unit

The best detecting element and control mechanism would be futile if the regulating unit or ultimate control element is less efficient in design than desirable or wrongly adjusted. Automatic control valves for gas or oil burners must have certain qualities in order to produce correct combustion control. Diaphragm control valves for pneumatic or hydraulic action should be characterized, i.e. where throttling control of burners is performed valve disc and seat should have special shapes.

★ ★ ★

For fuel-air ratio control, the characteristic of the oil or gas valve should mate the characteristic of the air control valve. Rate of flow control is usually achieved by varying the pressure loss through the valve, i.e. by throttling the fluid flow. The factors influencing valve size and type for temperature (combustion) control of oil or gas fired furnaces are: (1) fuel supply pressure and (2) the maximum volume of heating medium required for full furnace load. Oversizing of a control valve is just as bad as undersizing. For more or less rough and ready control it is possible to use butterfly types or rotary slide valves, but not for very close control. Efficient on/off burner control requires only globe valves, because their opening characteristics and flow-lift curves are of no importance.

★ ★ ★

It should be mentioned that for continuous conveyor furnace types automatic control of speed from the furnace temperature is another method of heat treatment control. Of importance are also safety precautions against overheating in case of failure of a control system, and for gas-heated furnaces the use of safety gadgets against explosion hazards. Often separate limit controllers are advisable, for example in an electrically heated salt bath a special limit stat protects the resistor windings, thus preventing excess heat if they remain in operation if the electric current remains full on after bath temperature has been reached. Cutting out of current input by the limit stat will produce a timely warning without bath temperature has been overstepped, simply by the temperature drop of the bath. Special alarm thermocouples at the most endangered oven zones are also highly advisable where damage to refractories would occur from localized excess heat. Quick change over from automatic control to hand control is another requirement put forward by oven personnel.

★ ★ ★

It should be noted that speed is most essential for efficient furnace temperature and pressure or draft control. Considerable forces are required for movement of heavy dampers and/or air valves, and hydraulic or electric control systems sometimes require up to three minutes to position a damper. Pneu-

REDUCE YOUR OPERATING EXPENSES WITH EXPERIENCED

Plandex Plastics Reworking Service

STRAINING, CLEANING AND PELLETIZING

Polyethylene Film!

Recompounding with Additives TO IMPROVE FLOW CHARACTERISTICS OF PLASTICS SCRAP

VIRGIN MATERIALS

Compounded To Your Recipes

LABORATORY QUALITY CONTROL WITH TESTS EVERY 30 MINUTES

• PLANDEX METHODS REDUCE WEIGHT LOSS AND IMPROVE YOUR PROFIT POSITION!

Plandex does not own a single ounce of scrap plastics, concentrating on streamlined reclaiming service alone. Our production line is equipped with Welding Engineers' customized dual worm compounder-extruders and with "know-how" that assures accurate interpretation of your specific requirements.

Write for literature or sales engineering appointment.

PLANDEX CORPORATION
DOWNINGTOWN, PA.
PHONE ANDREWS 9-2130

matic or pneumatic-electric systems react quicker and new electronic systems reduce time lags. Very many more or less elaborate furnace control systems have been worked out, but the most suitable control system will be the one which is stable, provides quick response, has a fully adjustable throttling range, and produces automatic reset in case of change of load. Some makers of controllers have specialized in this kind of work.

Angier, McLaurin-Jones and Stocker Join to Form Ludlow Papers, Inc.

Effective January 2, 1957, **McLaurin-Angier Co.**, Needham Heights 94, Mass., became **Ludlow Papers, Inc.**

★ ★ ★

The new company, a wholly owned subsidiary of **Ludlow Manufacturing and Sales Co.**, is a combination of three leaders in the field of paper converting: **McLaurin-Jones Co.** of Brookfield and Ware, Mass., and Homer, La.; **Angier Corp.** of Framingham, Mass.; and **Stocker Manufacturing Co.**, of Netcong and Stanhope, N. J.

★ ★ ★

Officers of the new company are **Henry M. Bliss,** President; **Albert J. Thiel,** Executive Vice President; **Fred Stocker,** Director of Coordination; **Robert J. Metzler,** Vice President in Charge of Sales; **Jack Holland,** Vice President in Charge of Manufacturing and **Joseph C. Mahoney,** Treasurer. The Board of Directors is comprised of these individuals plus **Malcolm B. Stone,** President of the parent firm.

★ ★ ★

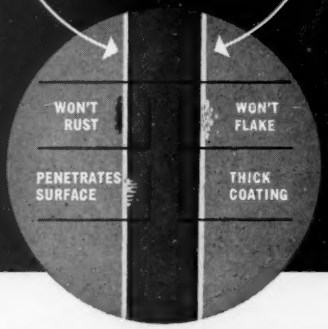
Other officers of the firm are **Malcolm J. Odell,** Director of Research; **E. Lee Turley,** Vice President, Fine Paper Sales; **Howard E. Murgatroyd,** Assistant Sales Manager, Fine Papers; **Everett D. Cookson,** Sales Manager, Tape Products; **Philip R. Palamountain,** Controller; and **Alton W. Noyes,** Director of Purchasing.

★ ★ ★

With this consolidation, Ludlow Papers emerges as an organization with the broadest range of paper converting operations in the industry. With a total of six manufacturing plants, the new company

Here's why you should coat high and low carbon steel rod with

BORAX 5 MOL.



No Dust... For a cleaner shop—pleasant working conditions and easier house keeping. Borax-coated rod does not dust or flake, can be held in storage longer and is pleasanter to handle.

No Baking... The Borax solution penetrates the porous surface of the metal, neutralizing deepseated acid, and eliminating the need for baking.

Longer Storage... The continuous film of Borax inhibits the formation of rust for a considerable period—particularly important where several days may elapse between coating and drawing.

Economical... A single dip in the Borax bath provides a thick durable coating which is very valuable where the wire is to be drawn in several stages.

Write to our Technical Department for further information.

United States Borax & Chemical Corporation
PACIFIC COAST BORAX COMPANY DIVISION
NEW YORK CHICAGO CLEVELAND KANSAS CITY PHILADELPHIA LOS ANGELES

MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

REELS SPOOLS

ALL SIZES

WOOD - PLYWOOD - WOOD - METAL

RETURNABLE • TO ORDER • NON-RETURNABLE

Samples and Prices on Request

DURKEE MFG. CO. • PINE RIVER, MINNESOTA

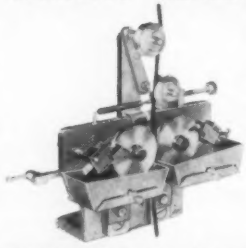
MUSIC WIRE and SPECIAL WIRES

Music Wire for Industrial Purposes
211 sizes Bright Polished, .0015" to .3437"
45 sizes Bright Tinned, .003" to .125"
Aluminum—Annealed—Belt Lacing—Brass, Soft and Spring—Copper, Bare and Tinned
Coppered Steel Spring—Galvanized—Tinned
Monel—Nickel Silver—Pure Soft Nickel—Oil Tempered, Steel Spring, Black Finish
Phosphor Bronze, Spring Temper—Pure Iron Wire—Resistance Wire,
Hoskins Chromel "A"—Stainless, Soft and Spring Temper—Tag Wire, 1000
in an Envelope—Florist Wire—Spooled and Coiled, 1/4-1/2-1-5#
Wires Straightened and Cut to length—Small Gauges—Small orders our specialty
Wires and Strands for the fishermen. Trolling Wires, Copper-Monel-Stainless.
Leader Wires, "Wilstabrite" Stainless and "Silverbrite" Music.

THE MALIN & COMPANY

2514 Vestry Ave. Established in 1884 Cleveland 13, Ohio

MARKING WHEELS and MACHINES for ELECTRIC WIRE



Gillies Engraved Concave Wheels are widely used for printing on rubber or plastic coated wire, for code or manufacturer identification. Machines print on ONE or BOTH SIDES in large legible letters. Wheels adaptable to any machine or we will supply machines. Wheels, shafts, ink pans and all accessories readily removable for quick and easy cleaning. Wheels made of hardened tool steel.

Send for samples of wire and prices on wheels and equipment

DUNCAN M. GILLIES CO., INC. Post Office Box 181 WEST BOYLSTON, MASS.

Telephone: West Boylston TE 5-4445

CONTACT US

If you have a wire electric conductor that fails because of too short life.

We may be able to design an electric conductor from TINSEL that will give many times the life obtained by the use of stranded wire.

• TRY US •

THE MONTGOMERY COMPANY

25 CANAL STREET Est. 1871 Tel.: National 3-3336 WINDSOR LOCKS, CONN.

possesses facilities for top-efficiency production of a wide range of gummed and coated papers, film and foil laminated papers, chemical-treated papers, and tapes to meet the needs of the printing, graphic arts, industrial, packaging and building fields.

★ ★ ★

Research activities of all three former firms have resulted in the development and introduction of such products as McLaurin-Jones guaranteed flat gummed papers, heat seal papers and ultra-sensitive chart papers; Angier rust preventive wrapping papers, grease-proof packaging papers and heavy duty gummed tapes; and Stocker glass-reinforced protective papers and aluminum-laminated waterproofing material. M-J Old Tavern Metallics, M-J Dry-Stik, Angier VPI Wrap, Induwrap, Scuf-Champ and Aluminum-Champ are tradenames, well known throughout industry, that will be offered by Ludlow Papers, Inc.

★ ★ ★

Sales and order activities will continue through the same channels as for the former organizations; McLaurin-Angier Co. and Stocker Manufacturing Co. With the consolidation, sales and service offices are now maintained in all trading areas for the United States and foreign countries.

Wire Rope for Logging

A revised bulletin has just been released by the **Macwhyte Company**, wire rope manufacturers, called "Wire Rope for Logging," number 5654.

★ ★ ★

Illustrations and complete descriptions of wire rope for each logging need are listed for easy reference. The purpose of this technical bulletin is to show the most popular logging ropes and the particular types of ropes best suited for each logging operation.

★ ★ ★

Bulletin No. 5654 is available from Macwhyte Company offices and distributors, or write Macwhyte Company, Advertising Department, Kenosha, Wis.

You Can Depend on National
DIAMOND POWDERS
For Consistent High Quality
They Are ALWAYS Clean, Sharp and Accurately Graded for Use.
ONLY TOP QUALITY GRADES!
SPECIAL SERVICE

DIAMOND POWDER RECLAIMING
Our exclusive process gives maximum recovery, highest salvage. Send us your old cotton, die washings, sludge and wheels.

DIAMOND GRINDING WHEELS
A complete line of fine quality wheels for industrial production.

Write for information and prices on our several services.

NATIONAL RESEARCH COMPANY
25530 LITTLE MACK AVE.
ST. CLAIR SHORES, MICH.

Use HEANIUM®

the NEW material that withstands hi-speed pressure of wire by the tons
HEANIUM®
IS THE BEST GUIDE . . . TO LOW COSTS.
If guide wear is a problem in your mill . . .
try HEANIUM®
HEANY INDUSTRIAL CERAMIC CORP.
NEW HAVEN 3, CONNECTICUT

Electropolishing Stainless Steels —A Useful Finishing Process

(*Continued from page 289*)

tank. Water content of the rinse serves to compensate for normal evaporation losses. In the case of Method 2 all solution adhering to the work is lost.

★ ★ ★

The solution lasts indefinitely. Nature and effect of the sludge or precipitate make this long life possible. The solution recommended for Method 1 precipitates the metal salts formed during electropolishing as an insoluble sludge on the bottom of the tank. This sludge can be easily removed with a suitable scoop. Method 2 produces a viscous sludge that must be disposed of by first decanting or syphoning off the upper liquid.

★ ★ ★

Power requirements are less for Method 1 than for Method 2. More surface area can be polished per unit of power.

★ ★ ★

The glycolic-sulfuric acid solution has these added advantages:

1. It operates over a wide range of current densities.
2. The glycolic-sulfuric acid solution remains liquid at room temperatures. This means that an operating unit can be shut down on weekends or at other times without having to maintain the solution at operating temperature.
3. The glycolic-sulfuric acid solution can be obtained in a pre-mixed condition. This simplifies preparation and maintenance of the bath.

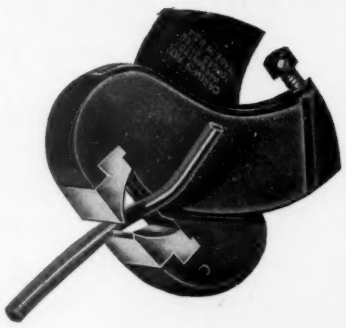
Method 2

This is the phosphoric acid-butyl alcohol solution.

★ ★ ★

Armco Electropolishing Method 2 is offered in the licensing arrangement optionally with Method 1. It is sometimes recommended where certain operational requirements make it more desirable than Method 1. These are its chief advantages:

1. The phosphoric acid-butyl alcohol solution of Method 2 has a wider range of flexibility in operation on the various grades and shapes than Method 1.
2. Method 2 is more effective for electropolishing the chromium stainless steels.
3. There is no corrosive effect on


QUALITY
You'll find proof of this in every "CAREW" Cutting Nipper. Since 1863 every "CAREW" has been the product of superior materials and painstaking workmanship. Intrinsic QUALITY underlies the overall efficiency, operating ease, and production economies you get with every "CAREW" Cutter.
STOCKED BY YOUR LOCAL MILL SUPPLY DEALER.
M. W. ROBINSON CO., INC.
ROCKFALL, CONN.

THE NELSON COMPANY
STANDARD OIL BLDG.. BALTIMORE 2. MD.
WOOD
REELS!
10" TO 120" IN DIAMETER
SET-UP
or
KNOCKED DOWN
QUICK DELIVERIES
SPECIALIZING IN WIRE ROPE REELS AND INEXPENSIVE "ONE-TRIP" REELS FOR CABLE
Thirty years of experience in quality woodworking.

WIRE DRAWING MACHINERY
AND EQUIPMENT

FINE WIRE MACHINES • SPOOLERS • POINTERS
PATENTING, TEMPERING, GALVANIZING AND TINNING EQUIPMENT FOR WIRE

WRITE FOR PRICES

SUPERIOR TOOL & MANUFACTURING CO.
172 UNION STREET • WORCESTER, MASS.

MOLDED WIRE BRAIDER SPOOLS

SMOOTH SPOOL HEADS will not break, warp, knick or rough-up—reducing maintenance costs. The instant locking feature saves time locating "dog-hole". Lighter than metal spools with less wear on Braider and Winder.

Contact us regarding your Spool Problems.

Stocked and sold exclusively by
STANDARD MILL SUPPLY COMPANY
31 ESTEN AVE., PAWTUCKET, R.I.
Telephone, PAwtucket 3-1534

WE BUY WE SELL

We Pay Highest Prices for Used Machinery

LARGE INVENTORY WIRE AND CABLE MACHINERY AVAILABLE—FOR SALE.

All Machines Reconditioned in Our Own Shop

WIRE & TEXTILE MACHINERY INC.
P. O. BOX 436, PAWTUCKET, R. I.

WAYNE WIRE DRAWING DIES

Quality in Diamonds + Perfection in Workmanship = Good Wire

Satisfactory DIAMOND DIES can only be made by those who have experience, skill and knowledge. WAYNE has all of these. Users have called WAYNE DIES "the best."

WAYNE WIRE DIE CO., 200 Pennsylvania Ave., Hillside, N. J.
Telephone: Elizabeth 2-2456

stainless steels when the current is turned off, or on sections of the work shielded from the current while the unit is operating.

4. Cathode selection and maintenance are somewhat simpler than for Method 1. A larger variety of cathode materials may be used. In some cases the electrolyte tank itself may serve as the cathode.
5. Like the glycolic-sulfuric acid solution, the phosphoric acid-butyl alcohol electrolyte stays liquid when cooled to room temperature.
6. The cost of equipment and maintenance is less than for Method 1.

★ ★ ★

Surface Area of Wire Goods: The current required for electropolishing is determined by the total area to be polished. All surfaces must be considered when calculating the area of a part. Threading or knurling will increase the area markedly. Table I will aid in making computations.

Table I

Brown & Sharp Gage No.	Wire Diameter In Inches	Area in Sq. Inches Per Linear Foot of Wire
22	.025	.95
20	.032	1.2
18	.040	1.5
14	.064	2.4
10	.102	3.9
1/8" round	.125	4.7
7	.144	5.4
6	.162	6.1
4	.204	7.7
1/4" round	.250	9.4
1	.289	10.9
1/0	.324	12.2
2/0	.364	13.7
3/0	.409	15.5
1/2" round	.500	18.9

Precautions: While the Armco Electropolishing Process will clean, deburr and impart a high luster to stainless steels, it naturally will not eliminate all surface imperfections. Pits and gouges will merely be cleaned out. This is why it is advisable to start with as smooth and dense a surface as possible to attain the most desirable results.

★ ★ ★

The unit should be inspected and cleaned thoroughly at regular intervals—at least every two weeks. Clean all anode and cathode contacts and spillages, and remove the flocculent copper that has collected on the cathodes.

★ ★ ★

Here are additional precautions:

1. The solution must be within concentration limits.
2. It must be within operating temperature limits.
3. Proper current density must be used.
4. Positive contact must be made.
5. Work must be racked to prevent gas-pocket formation.
6. Cathodes must be in their proper position.

Increase- HIS
METAL CUTTING POTENTIAL
Decrease- YOUR
METAL CUTTING COSTS
WITH THE NEW PORTER
WORK-STATION
CUTTER

No matter what kind of metal you cut — wire, rods, wire rope, cable or any other kind, you can save valuable man hours in your metal cutting operations with the rugged new Porter Work-Station Cutter. Can be fastened to work station welding unit or bolted to a plank and used as a portable cutter. Available in a variety of types of cutter heads for specific requirements. Notched Shear heads for cutting wire rope or cable — Center Cut heads for cutting copper, brass, aluminum, soft steel rods or wire — Center Cut round edge for hard spring wire, etc.
Available in two sizes:
1B cuts wire and cable up to 3/8" diameter.
3B cuts wire and cable up to 9/16" diameter.

Send us sample of metal to be cut and we will advise proper type of jaws required.

HKP®

WRITE FOR FREE PORTER CUTTER CATALOG
H. K. PORTER, INC. Somerville 43, Mass.

7. **Work must be free of lime, lead, copper, cadmium, grease or other coatings.**
8. **Enough time must be allowed for treatment, depending, of course, upon the original surface.**
9. **Work must be in the proper metallurgical condition.**
10. **When using Method 2, provide an adequate exhaust fan to prevent accumulation of butyl alcohol fumes.**
11. **Make sure that hydrogen and oxygen generated by the bath are sufficiently dissipated.**

Booklet on "Wonder Metals"

For those interested in some of the wonder metals that have gained increasing use and popularity in this age of metallurgy, the **Foote Mineral Co.,** 18 West Chelten Ave., Philadelphia 44, Pa., has prepared a 36 page booklet entitled "Foote Prints."

* * *

This describes the properties and applications of titanium, zirconium, hafnium, lithium and electrolytic manganese.

* * *

A copy of Foote Prints will be sent to those who are interested upon request to the Foote Mineral Company.

Folder on Extrusion Dies and Nozzles for Insulated Wire

An illustrated folder has been issued by the **Wire Tool Div., Bridgeport Jig Boring Company,** 303 Stratford Ave., Bridgeport, Conn., covering their line of steel and carbide dies and nozzles used in extruding machines in the manufacture of electric wire and cable.

* * *

Several different dies and nozzles are pictured and described. The company has made a specialty of these products, which have found ready acceptance in the insulated wire field because of the extreme care and accuracy with which they are made.

* * *

The company maintains stocks of standard types of dies and nozzles, or tips, for the benefit of fast customer service. These are made to fit all types of wire insulating extruders. However, special orders to specifications, are a regular part of the Bridgeport service.

* * *

The folder, entitled "Custom Made Tools for the Rubber and Plastic Insulated Wire Industry" will be mailed upon request.

DIAMOND POWDERS
OF FIRST QUALITY ONLY

For assured quality, accurately graded diamond powders

Specify
"DANFORTH"

They will cost more than "bargain basement" powders, but will finish your dies more economically.

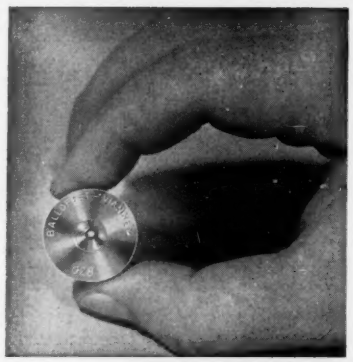
RECLAIMING SERVICE

We will take your waste materials and reclaim the diamond content for you, guaranteeing that it will be 99% or better pure. When returned, it will be properly graded for further use.

Ask for prices and information on our processes.

C. W. DANFORTH CO.
P. O. Box 448, Youngstown, Ohio
Established in 1912

BALLOFFET VIANNEY WIRE DIE CO., Inc.



All sizes from .081" down to .0004" in stock from New York.

Manufacturers of
Quality diamond dies since 1870

BALLOFFET VIANNEY WIRE DIE CO., Inc.
6825 ADAMS ST., GUTTENBERG, N. J.
Tel: Union 3-3393

TUNGSTEN CARBIDE WIRE DRAWING DIES

DESIGNED FOR LONG LIFE AND MAXIMUM WIRE PRODUCTION

Furnished semi-finished to within .001" to .002" of finished size at rough-drilled die prices. Require only light sizing and polishing before using. Our dies embody special design features that make for superior performance.

Also, a full line of carbide tooling for the Cold Heading Industry

EASTERN CARBIDE CORPORATION
NEW ROCHELLE, N. Y.

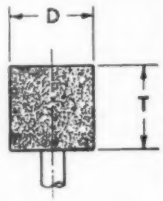
DIAMOND POWDER
Virgin or Reclaimed
All sizes

Finest Diamond Salvage Services

BOART
CRUSHED & MICRON GRADED

DWS DIAMOND WHEELS

TUNGSTEN CARBIDE MATRIX
100 GRIT



100 concentration mounted on mandrel 1½" long, ⅛" diam. Wheels in various diams. and thicknesses.

Send for sizes available and prices

INDUSTRIAL DIAMOND POWDERS, INC.
BOX 10602
PITTSBURGH 35, PENNSYLVANIA
Tel.: SYcamore 3-3308

DIAMOND POWDERS
Expert Reclaiming Service
MOLINA-STRAUS
DIAMOND PRODUCTS COMPANY
527 Fifth Ave., New York 17, N. Y.
Tel.: MUrray Hill 7-6825

DIAMOND DIES
.000's to .102"
For many years . . .
Outstanding in quality, workmanship and service.
FORT WAYNE WIRE DIE, INC.
2625 E. Pontiac St., Fort Wayne, Ind.

DIAMOND
and
TUNGSTEN CARBIDE
DIES
for all WIRE DRAWING purposes.
SPECIALISTS IN DIE REPAIR
WORK ON ALL TYPES OF DIES.
UNIVERSAL WIRE DIE CO.
951 Lincoln Ave., Cranford, N. J.
CRanford 6-0116

Kellogg Announces New Vulcanizing Agent

A new vulcanizing agent for the controlled curing of elastomers and resins capable of being cross-linked with organic polyamines has been announced by **The M. W. Kellogg Company**, Jersey City. The new product, an inner salt of W-amino hexyl carbamic acid, has been designated HMDA-Carbamate. First developed for use in vulcanizing KEL-F Elastomer, Kellogg's fluorocarbon rubber, HMDA-Carbamate shows promise as an efficient curative for other rubbers of the reactive halogen or acrylic ester type.

★ ★ ★

HMDA-Carbamate is a free flowing white powder, readily soluble in water, but insoluble in non-polar solvents. It is now available to rubber compounders and fabricators. A descriptive bulletin, together with price information, may be obtained by writing to The M. W. Kellogg Company, Chemical Manufacturing Division, Jersey City 3, N. J.

Davis-Standard Holds Insulating Demonstration

A wire insulating demonstration, for the benefit of some of the nation's leading wire and cable firms, was held on January 8th in the testing laboratory of **Davis-Stand-**

DIAMOND WIRE DRAWING DIES
DIAMOND POWDER AND COMPOUNDS
DIE RECUTTING SERVICE
CARBIDE DIES • TOOLS • PARTS
RUSCH WIRE DIE CORPORATION
CROTON-ON-HUDSON, N. Y.

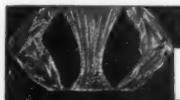
CARBIDE NAIL TOOLING for all NAIL MACHINES
Milled & Brazed Finished Recut
Many sizes carried in stock
PITTSBURGH CARBIDE DIE CO.
Monongahela, Penna. BLackburn 8-6959

DIAMOND DIES
mounted unmounted
For Precision Wire Drawing
BRENON, INC.
Experts in Fine Size Diamond Dies
R.F.D. #5, Box 400, New Brunswick, N. J.

DIAMOND WIRE DRAWING DIES and DIAMOND POWDER
INDIANA WIRE DIE COMPANY
314-324 E. Wallace St., Fort Wayne, Indiana
Phone: Harrison 4373

DIAMOND DIES .0006 - .120 DIAMOND POWDER
INDUSTRIAL AJAX SUPPLIES INC.
R.R. 4, P. O. Box 66, Fort Wayne, Ind.

NEW ENGLAND WIRE DIE CO.
7 Forsberg St., Worcester, Mass.
EXPERT RECUTTING
DIAMOND DIES, DIAMOND POWDERS
Eastern Representative of
Ajax Industrial Supplies, Inc.



DIAMOND DIES
PROFILED DIES
FINE SIZE DIES
VICTOR J. BOULIN INC.
10 FIRST STREET, PELHAM, N. Y.

Drawing Angle-Controlled
DIAMOND DIES
HOOSIER WIRE DIE, INC.
1730 Sinclair St., Ft. Wayne, Ind.

"NATDI"
A REVERSIBLE DIAMOND DIE
GREATER INITIAL PRODUCTION
MORE RECUTS — LONGER LIFE
NATIONAL WIRE DIE CO.
12 WEST 21st ST., NEW YORK 10, N. Y.

DIAMOND POWDER
Diamond Reclaiming Services
FORT WAYNE DIAMOND PRODUCTS, Inc.
2623 E. Pontiac Fort Wayne 5, Indiana

CREPED PAPER
COIL OR BAR WRAPS
NATIONAL WATERPROOF PAPERS, INC.
BEVERLY 1, N. J.

DIAMOND CARBIDE DIES
KELLY
WIRE DIE CORPORATION
19 W. 34th St. New York

TOOLS TALIDE DIES
WEAR PARTS
Talide Metal, the super hard tungsten carbide gives increased production, better finish, less down time and scrap on all wire mill operations.
METAL CARBIDES CORPORATION
YOUNGSTOWN 5, OHIO

WOOD REELS and SPOOLS
American Woodworking Company
1" to 60" Diameters. Send $1.00 for our catalogue of all wood products made in the U.S.A.
1674 N. Lowell Avenue
Chicago 39, Illinois

for finest quality products
start with
WEBB WIRE
Stainless • Needle • Nickel Alloy
WEBB WIRE
DIVISION OF THE CARPENTER STEEL CO.
NEW BRUNSWICK, N. J.

Wire Measuring...
PRODUCTIMETERS
Send for Catalog No. 40
Precision-built for accuracy and speed. Most complete line offered
DURANT MANUFACTURING CO.
1918 N. Buffum Street, Milwaukee 1, Wisconsin • 18 Thurbers Ave., Providence 5, R.I.

ZINC WIRE
THE PLATT BROS. & CO.
Waterbury 20, CONN.

NEP · SUMFOAM
ACID INHIBITOR • PICKLING COMPOUND
THE PARKIN CHEMICAL CO.
HIGHLAND BLDG. PITTSBURGH 6, PA.

Immediately Available
WIRE WORKING MACHINERY
FOURSLIDES: Baird, Nilson & Manville, Nos. 0, 1, 2, 3, 4, 5, 3-20, 4-26
U. S. Tool Co. No. 22, 28, & 33 Multislides
Sleeper & Hartley Spring Coilers Nos. 0, 1, 2, 3, 3½, 4, & 5 & Torrington W10 & W12
Vaughn Nos. 8, 10, & 12 Moto-Blocs
Waterbury No. 3 Bull Blocks, Duplex
Morgan 4 stand Wire Drawer with pointer and 100 H.P. motor drive & motor
Waterbury Nos. 1, 2, & 3 Continuous Wire Drawing Machines
PARTIAL STOCK LISTING
"The most diversified stock of machinery in the country. If it's machinery we have it."
National Machinery Exchange
130 Mott St., New York 13, N. Y.
CAnal 6-2470

ard, Division of Franklin Research Corp., Mystic, Conn.

★ ★ ★

During the demonstration, Davis-Standard's 2" standard Therma-Fin Extruder insulated a wire with super Dylan* polyethylene, a product of the Chemical Division of the **Koppers Co., Inc.**, Pittsburgh, who with Davis-Standard sponsored the affair.

★ ★ ★

Among the benefits of super Dylan* polyethylene are: improved heat resistance, increased tensile strength, greater rigidity, low permeability and excellent low temperature impact strength.

★ ★ ★

Davis-Standard maintains a complete wire insulating set-up within its testing laboratory which is available to any company desirous of testing its products on their complete line of wire insulating machinery.

* Koppers Trademark

Kaiser Producing Billets by New Process

Aluminum billets for the extrusion and electrical conductor industries are now being produced in the new direct chill casting plant at **Kaiser Aluminum & Chemical Corporation's** Chalmette works near New Orleans, La.

★ ★ ★

The new casting facility, which was constructed at a cost of $1,600,000, has a capacity for producing 10,000,000 pounds of billets per month. Costly remelt of pig metal is eliminated by the process.

★ ★ ★

The billet facility casts potroom metal in round or square forms 19 feet long. The billets are cut to desired lengths and then placed in homogenizing furnaces to improve the metal's workability.

AJAX ELECTRIC
SALT BATH FURNACES
for fast, economical heat treatment
AJAX ELECTRIC COMPANY
928 Frankford Ave., Philadelphia 23, Pa.

SLEEPER & HARTLEY, Inc.
Designers and Builders
SPRING COILERS
WIRE WORKING MACHINERY
WIRE MILL EQUIPMENT
SPECIAL MACHINERY
Address Inquiries to
Box 1249
WORCESTER, MASS.

EMORY
SPOOLERS AND TRAVERSES
ROBERT J. EMORY CO.
31 E. RUNYON ST., NEWARK 5, N. J.

TESTING EQUIPMENT
WIRE MACHINERY
PAYOFFPAK
Federal Manufacturing Co.
Wallingford, Conn.

METALLIZING WIRE
PURE ZINC and CADMIUM
Other Fine Bare Wires
Manufactured to Your Specifications
IMMEDIATE DELIVERY
STAMFORD PROCESSING CO.
10-24 S. Water St., Peekskill, N. Y.

CLEVELAND TRAMRAIL
Division of
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE, OHIO
Leading manufacturers of
OVERHEAD MATERIALS HANDLING EQUIPMENT
for the Wire and Wire Products Industry

Have you a Wire Drawing Problem?
"WHEN TRYING LUBRICANTS — TRI STATE'S"
Tri State Industrial Lubricants, Inc.
MORTON GROVE, ILLINOIS
Phone: Orchard 3-1797

WIRE DRAWING MACHINERY
AND EQUIPMENT
Rod Frames — 16" Frames, 8" Frames — Take-Up Frame, Wire — Pointers — Puller Tongs — General and heat resisting alloy castings for wire mill use.
Circulars on Request
E. J. SCUDDER FOUNDRY & MACHINE CO.
TRENTON, N. J.

STRAND-BUFFALO CORP.
No. Tonawanda, N. Y. (near Buffalo)
REELS
WOOD and PLYWOOD
Manufactured to Your Specifications

Engineering and Professional Services

LANCASTER, ALLWINE & ROMMEL

REGISTERED PATENT ATTORNEYS
Suite 438, 815—15th St., N. W.
Washington 5, D. C.

Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions. Booklet and form "Evidence of Conception" forwarded upon request.

CONSULTING WIRE MILL ENGINEER
Specializing in Wire Mill Machinery, Plant Layout and Production Techniques.
CLARENCE S. ARMS
Sleeper & Hartley, Incorporated
P.O. Box 1249 • Worcester, Mass.

LINE—GORCY
mechanical
wire rod descalers
FISHER ASSOCIATES
122 East 42nd St. New York 17, N. Y.

IOI
Engineered Application of Heat in Continuous Processing Systems
INDUSTRIAL OVENS, INC.
13825 TRISKETT ROAD
CLEVELAND 11, OHIO

WANTED
Used Test Equipment
Scott Tester, etc.
Reply to Box 900
WIRE & WIRE PRODUCTS
453 Main Street, Stamford, Conn.

WANTED
Foreman for drawing department, High and Low Carbon Wire Mill. Give full particulars.
Reply to Box 897
WIRE & WIRE PRODUCTS
453 Main Street Stamford, Conn.

DESIGN ENGINEER
Excellent opportunity for experienced designer of Wire Machinery or Machine Tools. Graduate engineer with several years design experience required. The company is long established and pre-eminent in its field. This is a long term, well paid challenge for the right man.
Send resume including education, design experience and salary requirements to:
Box 902
WIRE AND WIRE PRODUCTS
453 Main Street Stamford, Conn.

Wire mill in middle west wants Electrical Engineer. Prefer mechanical engineering background, but not essential. Give full particulars.
Reply to Box 896
WIRE & WIRE PRODUCTS
453 Main Street Stamford, Conn.

EXPERIENCED PLASTIC WIRE AND CABLE MAN
Capable of taking charge of complete manufacturing operation wanted by small but rapidly expanding concern. The man we are seeking is ambitious, aggressive, and has the ability to think and act with sufficient initiative to get results. The individual selected will have an opportunity to obtain an interest in the company.
Reply stating experience, age and salary desired. All replies held in strictest confidence.
Box 901
WIRE & WIRE PRODUCTS
453 Main Street Stamford, Conn.

WANTED
SALES AND OFFICE MAN, experienced industrial wire cloth and fine wires. Good opportunity, salary plus commission. State qualifications. Send resume to:
Box 899
WIRE AND WIRE PRODUCTS
453 Main Street Stamford, Conn.

WANTED
Experienced man to sell pickling compounds to steel fabricators. Must be able to travel most of the time and should have some wire or steel mill experience.
L. O. BURRELL CO., INC.
Kirkover St. & P.R.R. Buffalo 6, N. Y.

KLEANRITE—INHIBITORS
Pickling Products For All Steels
L. O. BURRELL CO., INC.
Kirkover St. & P.R.R. Buffalo 6, N. Y.

FOR SALE
TORRINGTON
2-STAND FLAT WIRE MILL LINE
- 3-Motor Drive with Special Tandem Control
- Flattening Rolls 6" Dia., Hi-carbon hi-chrome steel.
- Non-Driven edger between stands.
- Payoff for hank type coils.
- Winder with Collapsible Block for 250 lb. coils.
- Pratt & Whitney Magnetic Gauges for Thickness and Width
- Built-in Coolant Circulating System with Tank and Pump.
- Speed Adjustable from 333 to 1000 feet per minute.
- Practically new condition.
- Machine suitable for Zipper and Magnet Wire Work.

UNIQUE BALANCE CO.
41 Magee Ave.
Stamford, Conn.

Sells Bristol Plant to Kaiser

The wire and cable business of **United States Rubber Co.** has been sold to **Kaiser Aluminum & Chemical Corp.**, it was announced by the board of directors of the rubber company. The sale became effective February 1st. It included the plant, property and equipment in Bristol, R. I., **H. E. Humphreys, Jr.**, chairman, announced. In addition, Kaiser Aluminum will take over U. S. Rubber's wire and cable inventories, sales organization and distribution network.

★ ★ ★

Mr. Humphreys said U. S. Rubber has been considering getting out of the wire business for some time, since it is more closely allied to the metals field than to the rubber industry. He added that the company expects to continue to supply the rubber used for wire insulation at the Bristol plant, which has produced insulated wire and cable since 1892.

Bulletin on Welding Aluminum

"Arc Weld Aluminum As Easily As Mild Steel" is the title of a new two-color folder describing "Low Amp" EutecTrode 2101 DC, the new electrode for aluminum featuring an extruded coating recently introduced by **Eutectic Welding Alloys Corp.**, 40-40 172nd Street, Flushing 58, N. Y. Free copies are available by writing Eutectic's Technical Information Service for TIS 2891.

Index to Advertisers

A

Acrometal Products, Inc. 325
Ajax Electric Company 345
Ajax Industrial Supplies, Inc. 344
Allis, Louis Co., The 252
American Insulating Machinery Company 319
American Pulley Company 256-B
American Woodworking Company 345
Apco Mossberg Company 312
Apex Alkali Products Co. 279
Arkell Safety Bag Company 243
Arms, Clarence S. 346

B

Baird Machine Co., The 259
Balloffet-Vianney Wire Die Co., Inc. 343
Beard Machine Co., Inc. 334
Boulin Inc., Victor J. 344
Brenon Inc. 344
Bridge Mfg. Company 281
Burdwood, Inc., Howard A. 332
Burrell Co., Inc. 346

C

Camden Wire Co., Inc. 330
Carl Mayer Corp., The 337
Carpenter Steel Company-Webb Wire Div. 345
Cleveland Tramrail Division of
The Cleveland Crane & Engineering Co. 345
Colorado Fuel & Iron Corporation, Wickwire Div. ..... 264 and 265
Continental Can Company ..... Inside Front Cover
Continental Steel Corporation 315
Cook Manufacturing Co. 260
Coul'er & McKenzie Machine Co., Inc., The 304
Crucible Steel Co. of America 247

D

Danforth Company, C. W. 343
Davis-Standard Division of the Franklin Research Corporation.. 272-B
Diamond Tool Research Co., Inc. 331
Durant Manufacturing Co. 345
Durkee Manufacturing Co., Inc. 340
Dykrex Corporation of America 338

E

Eastern Carbide Corporation 343
Edmands Co., The 333
Electric Furnace Company, The ..... Back Cover
Elgin National Watch Co., Abrasives Div. 297
Emory Company, Robert J. 345
Entwistle Manufacturing Corporation 267
E.V.G.—Maschinen & Stahl, A. G.—Richard E. Kleinhans 242

F

Federal Manufacturing Co. 345
Firth Sterling, Inc. 258
Fisher Associates 346
Fort Wayne Diamond Products, Inc. 344
Fort Wayne Wire Die, Inc. 344

G

Gillies Co., Inc., Duncan M. 340
Glader Machine Works, William 318
Godderidge Ste 253

H

Hartford Special Machinery Co., The 273
Haskell-Dawes Machine Company, Inc. 335
Heany Industrial Ceramic Corporation 341
Herborn Maschinenfabrik 269
Hoosier Wire Die Inc. 344
Hubbard Spool Co. 250

I

Indiana Wire Die Company 344
Industrial Diamond Powders, Inc. 344
Industrial Ovens, Inc. 346

J

Jarke Manufacturing Company ..... 334 and 335
Jones & Laughlin Steel Corp. 280

K

Kaiser Aluminum & Chemical Corp. 276
Kelly Wire Die Corporation 344
Keystone Steel & Wire Company 256-A

L

Lancaster, Allwine & Rommel 346
Larmuth (1947) Ltd. 336
Lewis Machine Company, The 257

M

Malin & Company, The 340
Masonware Company 320
Maschinenfabrik K. A. Niehaus 327
Metal Carbides Corporation 345
Metallurgical Products Dept. of G.E. ..... 248 and 249
Mettler Machine Tool, Inc. 282
Michigan Oven Company 274
Micro Products Company 311
Miller Company, Inc., R. H. 286
Molina-Straus Diamond Products Company 344
Monsanto Chemical Company ..... 288-A, B, C & D
Montgomery Company, The 340
Morgan Construction Company 244
Morgardshammar Mek Verkstads A B 283
Mossberg Pressed Steel Corporation 324

N

National Machinery Exchange 345
National Research Co. 341
National Standard Company 262
National Waterproof Papers, Inc. 344
National Wire Die Company 344
Naugatuck Chemical Div. of U.S. Rubber Company 261
Nelson Company, The 341
New England Butt Company 246
New England Wire Die Co. 344
New York Engineering Company 316
Nichols Wire & Aluminum Co. 275
Nilson Machine Co., The A. H. 321
Nopco Chemical Company 254
Norton Company 322

O

Owens Corning Fiberglas Corp. 277

P

Pacific Coast Borax Company Div.,
United States Borax & Chemical Corp. 339
Parkin Chemical Company, The 345
Patterson Machine Co., George C., The 333
Peschel Electronics, Inc. 337
Pittsburgh Carbide Die Co. 344
Plandex Corporation 339
Platt Brothers & Co., The 345
Plymouth Cordage Company 323
Porter, Inc., H. K. 343
Pourtier Pere et Fils 324

R

Republic Steel Corporation, Pressed Steel Div. 245
Riverside-Alloy Metal Division H. K. Porter Co., Inc. 317
Robinson Co., Inc., M. W. 341
Roebling's Sons Corp., John A. 272-A
Rome Soap Manufacturing Company 336
Royle & Sons, John 326
Rusch Wire Die Corporation 344

S

Scott Testers, Inc. 331
Scudder Foundry & Machine Co., E. J. 345
Sjogren Tool & Machine Co., Inc. 328
Sleeper & Hartley, Inc. 345
Stamford Processing Co., Inc. 345
Standard Industrial Compounds Co., Inc. 241
Standard Mill Supply Company 342
Strand-Buffalo Corp. 345
Superior Tool & Mfg. Co. 342
Swift & Company 256
Syncro Machine Company 270

T

Terkelsen Machine Company 329
Tinius Olsen Testing Machine Company 313
Torrington Mfg. Co., The 255
Tri-State Industrial Lubricants 345

U

United States Borax & Chemical Corporation,
Pacific Coast Borax Company Div. 339
United States Industrial Chemicals Co., Div. of
National Distillers Products Corp. 266
U. S. Rubber Company, Naugatuck Chemical Div. 261
United Wire & Supply Corporation 271
Universal Wire Die Co. 344

V

Vascoloy-Ramet Corporation 284
Vaughn Machinery Company, The ..... Front Cover

W

Wardwell Braiding Machine Co. 314
Waterbury-Farrel Foundry & Machine Co. 263
Watson Machine Company ..... Inside Back Cover
Wayne Wire Die Co. 342
Webb Wire Div., Carpenter Steel Company 345
Wickwire Div., Colorado Fuel & Iron Corp. 264-265
Wilson, Lee, Engineering Co., Inc. 251
Wire & Textile Machinery, Inc. 342
Wire Tool Division, Bridgeport Jig Boring Company 332

Y

Youngstown Sheet & Tube Company, The 268

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.
Only advertisers who have contracted for six or more insertions are listed in this section.

ABRASIVES—
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ADJUSTABLE SPEED DRIVES—
The Louis Allis Company, Milwaukee, Wisc.

ANNEALING MACHINES — Electric Resistance
Synero Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

BAKERS—
(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg C., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Plastic Mold Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

BORAX—Wire Drawing
United States Borax & Chemical Corp., Pacific Coast Borax Co. Div., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CABLE FILLERS—Paper
Plymouth Cordage Company, Plymouth, Mass.

CAPSTANS—for Wire (also Caterpillar Types)
Entwistle Manufacturing Corporation, Providence, R. I.
Litzler, C. A. Co., Inc., Cleveland, Ohio.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CATALYSTS—For Fume Elimination
Oxy-Catalyst, Inc., Industrial Div., Wayne, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee Engr. Co., Cleveland, Ohio

CLOTH—WIRE, All Metals
Baker, James S., (Imports) Co., San Francisco, Calif.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Tri-State Industrial Lubricants, Morton Grove, Illinois.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago
Rusch Wire Die Corporation, Croton-on-Hudson, N. Y.

COMPOUNDS—Extrusion for Wire
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

COMPOUNDS—For Improving Drawing & Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Vinyl
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Rome Soap Manufacturing Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.
Tri-State Industrial Lubricants, Morton Grove, Illinois.
United States Borax & Chemical Corp., Pacific Coast Borax Co. Div., New York, N. Y.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Plastic Mold & Engineering Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit.
Vascoloy-Ramet Corp., Waukegan, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Somerville, Mass.
Robinson, M. W. Co., Rockfall, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Molina-Straus Diamond Products Co., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Molina-Straus Diamond Products Co., New York, N. Y.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Industrial Diamond Powders, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Molina-Straus Diamond Products Co., New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
Vascoloy-Ramet Corp., Waukegan, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., New Brunswick, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Drawing Angle Controlled
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
National Wire Die Co., New York, N. Y.

DIES—Extrusion
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Polishing, Asbestos Wire
Beard Machine Co., York, Pa.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., New Brunswick, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit.
National Wire Die Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adustable Speed
The Louis Allis Company, Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio
Hubbard Spool Company, Garrett, Ind.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

ENGINEERS—Consulting
Wire Mill—Clarence S. Arms, Worcester, Mass.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS—
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio

FURNACES—Galvanizing Equipment
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.

FURNACES—Resisting Heating, Strand
Electric Furnace Company, Salem, Ohio

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio

FURNACES—Strand Annealing
Electric Furnace Company, Salem, Ohio

GAUGES—Wire Diameter, Continuous
Industrial Gauges Corporation, West Englewood, N. J.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GEARMOTORS—
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HARDSURFACING ALLOYS—
(See Alloys—Hardsurfacing)

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Entwistle Manufacturing Corporation, Providence, R. I.

INSULATING MATERIALS—
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
General Electric Company, Alkanex Wire Enamel Dept., Schenectady, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plymouth Cordage Company, Plymouth, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

INSULATING MATERIALS—Paper (For Electric Wire Cable)
Plymouth Cordage Company, Plymouth, Mass.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The. Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Rome Soap Mfg. Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Tri-State Industrial Lubricants, Morton Grove, Illinois.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik. Reutlingen, Wurtt, Germany

MACHINERY—Braiding
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios Maschinenfabrik, Reutlingen, Wurtt, Germany

MACHINERY—Closing Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Morgardshammer Mek Verstads A. B., Morgardshammer, Sweden.
National Mach'y Exch (Used), New York
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Herborn, Germany

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven, Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios Maschinenfabrik, Reutlingen, Wurtt, Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Mfg. Co., Wallingford, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Beard Machine Co., York, Pa.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Labeling Electric Wire
Dewyer, Inc., Libertyville, Ill.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, O.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
E. V. G., Richard Kleinhans, New York, N. Y.
Maschinen & Stahl A. G., c/o Richard Kleinhans, Zurich, Switzerland
Wafios Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Durant Mfg Co., Milwaukee, Wis.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Plating
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York,
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Polishing Asbestos Wire
Beard Machine Co., York, Pa.

MACHINERY—Printing on Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gillies, Duncan M. Co., Inc., Boylston, Mass.

MACHINERY—Re-Spooling
Emory, Robert J., Co., Newark, N. J.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machinery Inc., Northboro, Mass.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Spark Testing
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Staple
Nilson, A. H. Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Straightening & Cutting
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Patterson Machine, Geo. C., Co., Cleveland, Ohio

MACHINERY—Stranding
Godderidge Ste., Houilles, (Seine-et-Oise), France
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Stripping Electric Wire & Cable
Burdwood, Howard A., Inc., Portland, Maine

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Fenn Manufacturing Co., Newington, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Federal Mfg. Co., Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Turks Head
Fenn Manufacturing Co., Newington, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
E. V. G., Richard Kleinhans, New York, N. Y.
Maschinen & Stahl A. G., c/o Richard Kleinhans, Zurich, Switzerland

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery —Welding Wire Fabrics)

MACHINERY—Winding Wire
Emory, Robert J., Newark, N. J.
Federal Manufacturing Company, Wallingford, Conn.
Fenn Manufacturing Co., Newington, Conn.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Federal Mfg. Co., Wallingford, Conn.
Fenn Mfg. Co., Newington, Conn.
Herborn, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
Morgardshammer Mek Verstads AB, Morgardshammer, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A.C. & D.C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAPER—Creped Wrapping
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Rinkle, Krinkle Paper Co., Inc., Boston, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Rinkle, Krinkle Paper Co., Inc., Boston, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—Insulating
Plymouth Cordage Company, Plymouth, Mass.

PATENT—ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Monsanto Chemical Company, Plastics Division, St. Louis, Mo.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

PLASTICS COMPOUNDING—Custom
Plandex Corporation, Downingtown, Pa.

PLASTICS—for Wire Insulation
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plandex Corporation, Downingtown, Pa.
Shawinigan Resins Corporation, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

POINTING WIRE
Main, Robert A. & Sons, Inc., Paramus, N. J.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gillies, Duncan M. Co., Inc. Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

PUMPS—Molten Metal
Fisher Associates, New York, N. Y.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois.

REEL AND TENSION STANDS—
Industrial Ovens, Inc., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Garrett, Ind.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company The, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company The, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Masonware Company, East Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., New York, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company The, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
Masonware Company, East Providence, R. I.
McCaskie, Inc., William, Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Company, New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Phosphor Bronze Div., Seymour, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Braider, Wire
Plastic Mold & Engineering Co., Providence, R. I.

SPOOLS—Plastic
Hubbard Spool Company, Garrett, Indiana
Standard Mill Supply, Co., Pawtucket, R. I.

SPOOLS—Stamped Metal for Retail Wire Sales
Masonware Company, East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TABLES—Press Feeding
Jarke Manufacturing Co., Chicago, Illinois.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Alkanex Wire Enamel Dept., Schenectady, N. Y.
Shawinigan Resins Corporation, Springfield, Mass.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Company, Phosphor Bronze Div., Seymour, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Bunched & Stranded, Copper
Camden Wire Co., Camden, N. Y.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Camden Wire Co., Camden, N. Y.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Camden Wire Co., Inc., Camden, N. Y.
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat, Fine
Montgomery Co., The, Windsor Locks, Conn.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Riverside-Alloy Metal Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Company, Phosphor Bronze Div., Seymour, Conn.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
Riverside-Alloy Metal Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Seymour Mfg. Co., Phosphor Bronze Div., Seymour, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Pointed
Main, Robert A. & Sons, Inc., Paramus, N. J.

WIRE—Silver Plated Copper
Camden Wire Co., Camden, N. Y.

WIRE—Special Shapes
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Riverside-Alloy Metal Div., H. K. Porter Company, Inc., Prospect Park, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Riverside-Alloy Metal Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Roebling's John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Crucible Steel Co. of America, Pittsburgh, Pa.
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Crucible Steel Co. of America, Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Riverside-Alloy Metal Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Tinned Copper
Camden Wire Co., Camden, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

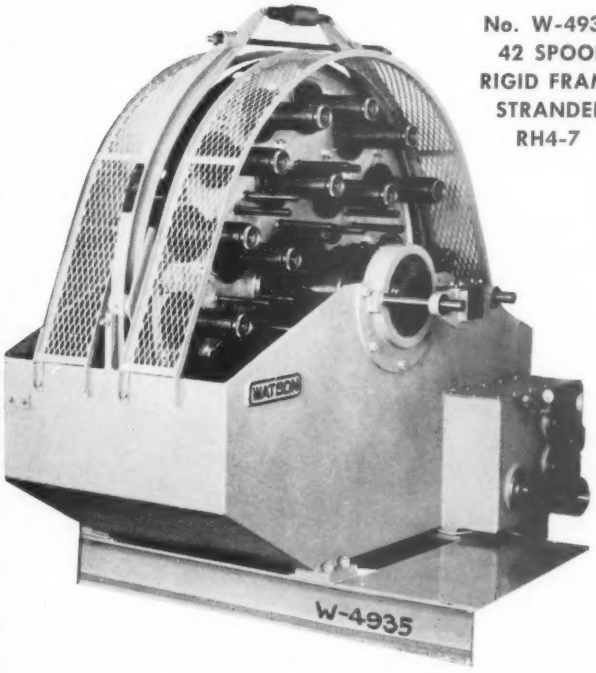
PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

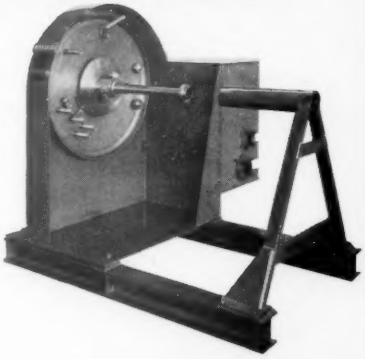
SERVICE ENTRANCE CABLE MACHINES

COMPLETE MACHINES CAN BE SUPPLIED IN ANY OF THE MANY COMBINATIONS OF UNITS OF WHICH A FEW OF THE AVAILABLE COMPONENTS ARE SHOWN HERE.

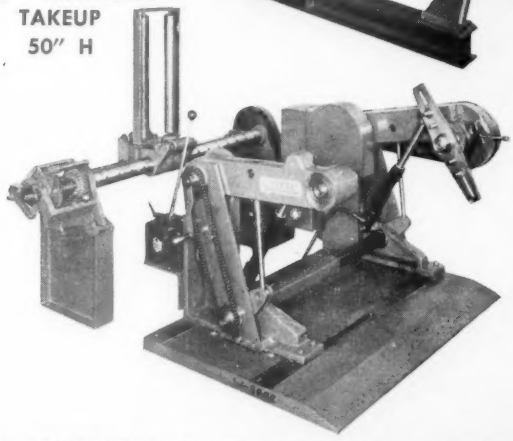


No. W-4935
42 SPOOL
RIGID FRAME
STRANDER
RH4-7

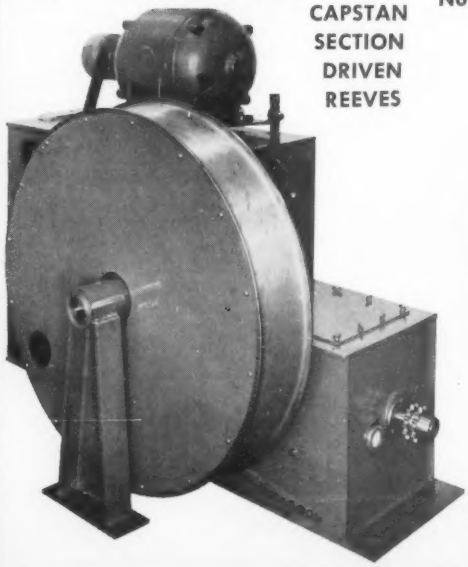
No. W-4712
SINGLE
CONCENTRIC
TAPER
20" SC-BT



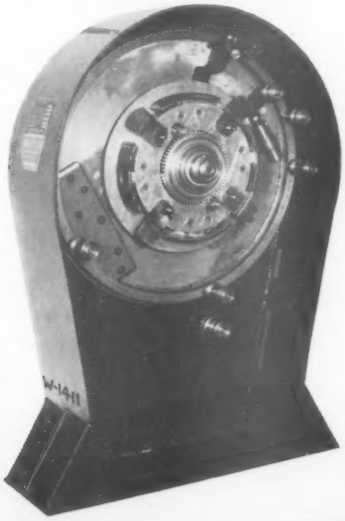
No. W-3652
HYDRAULIC LIFT
"SHAFTLESS"
TAKEUP
50" H



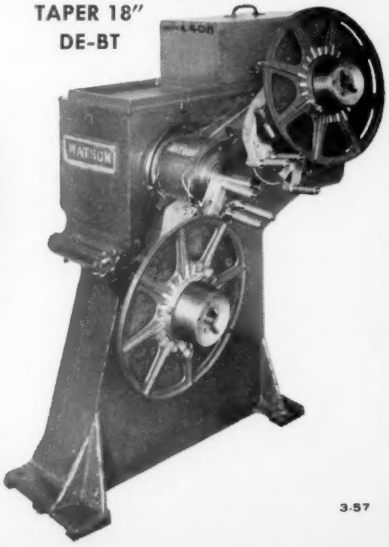
No. W-4390b 36" SINGLE WHEEL
CAPSTAN
SECTION
DRIVEN
REEVES



No. W-1411 SINGLE CONCENTRIC
STEEL TAPER 19" SC-BT

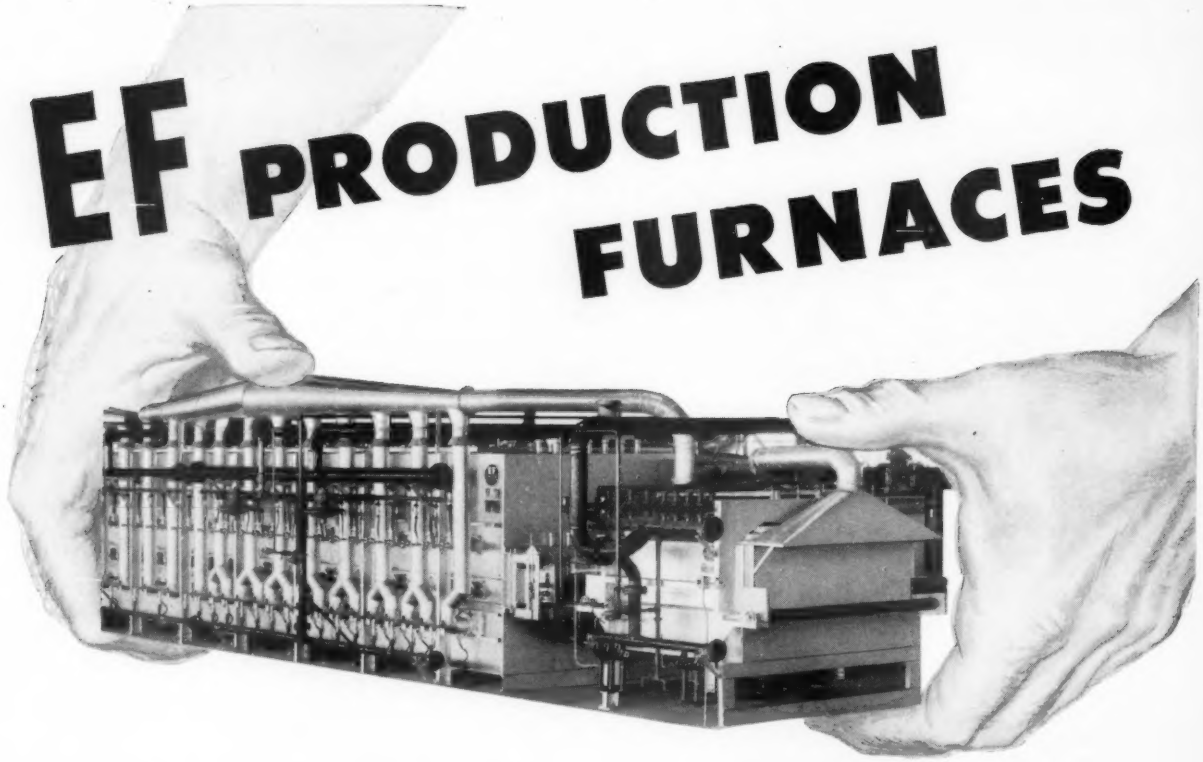


No. W-4408 DOUBLE ECCENTRIC
TAPER 18"
DE-BT



3-57

EF PRODUCTION FURNACES

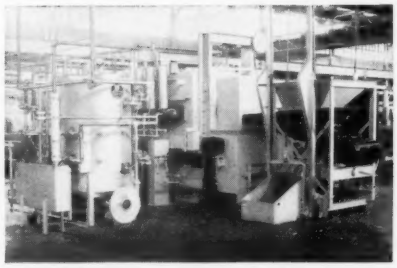


Designed, Built and Installed --- Ready to Produce

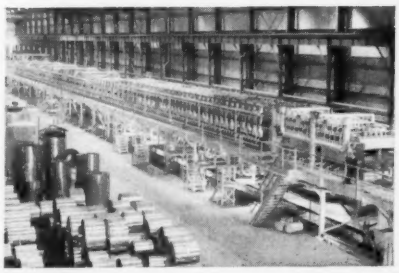
● It costs less to let experienced heat treating furnace engineers handle all phases of your heat processing furnace projects. Then you can be sure the design and type of furnace, the method of heating, the special atmosphere, the material handling and other equipment are all best suited for your particular product and process. All phases will be synchronized and coordinated to your production schedules, simplifying the entire operation and assuring profitable and trouble-free service.

EF engineers have served many of the country's most successful companies, and have handled many complete projects . . . some of extremely confidential nature.

On your next heat processing or furnace project, no matter how large or unusual, take advantage of the extensive experience and complete service offered by EF heat processing engineers — YOU'LL FIND IT PAYS.



A small, complete, compact installation consisting of an EF continuous scale-free hardening and gas carburizing furnace, a special combination endothermic and exothermic gas generator, automatic feeder, quench and discharge equipment.



A large combination gas fired and electrically heated continuous galvanizing furnace installation (over 300 feet long). As usual this equipment was completed and in production on schedule, and the first coil run thru was accepted as first class salable material.

THE ELECTRIC FURNACE CO.

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

Canadian Associates • Canefco Limited • Toronto 1, Canada